

Groupe D0-LPSC

Bilan et demande de continuation

- **Motivations**
- **La collaboration DØ**
- **Le Tevatron et le détecteur D0**
- **Quelques résultats récents**
- **Bilan d'activité 1999-2003 de D0-LPSC**
- **Demande de continuation**
- **Conclusion**

Motivations

- DØ n'est approuvé par l'IN2P3 que jusqu'à la fin 2003, une demande de prolongation va être présentée au CS de l'IN2P3 (4-5 Juin) ;
- Cette continuation doit aussi être discutée au CS du LPSC ;
- Le Tevatron et l'expérience D0 sont en phase de fonctionnement performant ;
- Jusqu'au démarrage du LHC (prévu en 2007), le Tevatron est la seule machine au monde capable de produire et de pouvoir étudier le quark top et de rechercher de nouvelles particules jusqu'à des masses de quelques centaines de GeV.

Motivations (suite)

- Les leptons et/ou le quark b sont présents dans la désintégration
 - du quark top
 - du Higgs
 - des particules supersymétriques

Le groupe de D0-LPSC travaille :

- sur la reconstruction et l'identification des électrons et des jets de quark b (étiquetage par électron non isolé)
- sur la recherche de particules supersymétriques

Nous désirons donc continuer à contribuer à la physique du Tevatron qui nous prépare à celle du LHC

La Collaboration D0

The DØ Collaboration

AZ U. of Arizona
 CA U. of California, Berkeley
 U. of California, Riverside
 Cal. State U., Fresno
 Lawrence Berkeley Nat. Lab.
 FL Florida State U.
 IL Fermilab
 U. of Illinois, Chicago
 Northern Illinois U.
 Northwestern U.
 IN Indiana U.
 U. of Notre Dame
 IA Iowa State U.
 KS U. of Kansas
 Kansas State U.
 LA Louisiana Tech U.
 MD U. of Maryland
 MA Boston U.
 Northeastern U.
 MI U. of Michigan
 Michigan State U.
 NE U. of Nebraska
 NJ Princeton U.
 NY Columbia U.
 U. of Rochester
 SUNY, Stony Brook
 Brookhaven Nat. Lab.
 OK Langston U.
 U. of Oklahoma
 RI Brown U.
 TX U. of Texas at Arlington
 Texas A&M U.
 Rice U.
 VA U. of Virginia
 WA U. of Washington

U. de Buenos Aires
 LAFEX, CBPF, Rio de Janeiro
 State U. do Rio de Janeiro
 State U. Paulista, São Paulo
 IHEP, Beijing
 U. de los Andes, Bogotá
 Charles U., Prague
 Czech Tech. U., Prague
 Academy of Sciences, Prague
 U. San Francisco de Quito
 ISN, IN2P3, Grenoble
 CPPM, IN2P3, Marseille
 LAL, IN2P3, Orsay
 LPNHE, IN2P3, Paris
 DAPNIA/SPP, CEA, Saclay
 IReS, Strasbourg
 IPN, IN2P3, Villeurbanne
 U. of Aachen
 Bonn U.
 U. of Freiburg
 U. of Mainz
 Ludwig-Maximilians U., Munich
 U. of Wuppertal

FOM-NIKHEF, Amsterdam
 U. of Amsterdam / NIKHEF
 U. of Nijmegen / NIKHEF
 JINR, Dubna
 ITEP, Moscow
 Moscow State U.
 IHEP, Protvino
 PNPI, St. Petersburg
 Lund U.
 RIT, Stockholm
 Stockholm U.
 Uppsala U.
 Lancaster U.
 Imperial College, London
 U. of Manchester
 HCIP, Hochiminh City

University College, Dublin
 KDL, Korea U., Seoul
 CINVESTAV, Mexico City

Ann Hansen, UC Riverside

18 pays
79 instituts
650 physiciens

D0-France :
IN2P3 (6 instituts)
et SACLAY
62 physiciens et
doctorants

Le groupe D0-LPSC

- **2003 : 4.5 FTE**

Chercheurs :

Sabine Crépe-Renaudin

Jan Stark

Enseignants-chercheurs : **Yannick Arnoud**

Gérard Sajot

Doctorant :

Anne-Marie Magnan (2002-2005)

Stagiaire de DEA :

Gwenael Le Gorrec (2003-2006)

Visiteur étranger :

Oleg Kouznetsov (->31/08/2003)

- **2002: 5.5 FTE**

- **2001: 5 FTE**

- **2000: 4.75 FTE**

- **1999 : 3.5 FTE**

- **février 1999 D0 Grenoble membre officiel de D0**

- **participation à D0 depuis mi-1998**

Les anciens du groupe D0-LPSC

Auguste Besson (thèse 1999-2002) **ATER UHA groupe D0**

Pavel Demine (thèse 1999-2002) **Postdoc SACLAY groupe D0**

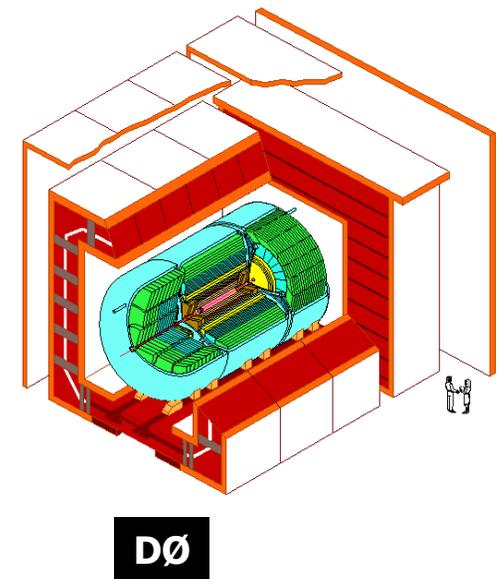
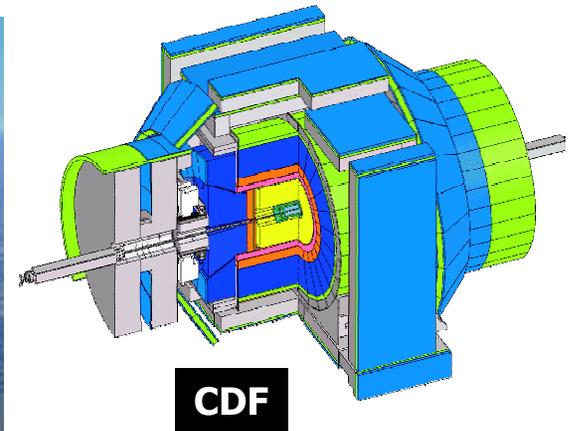
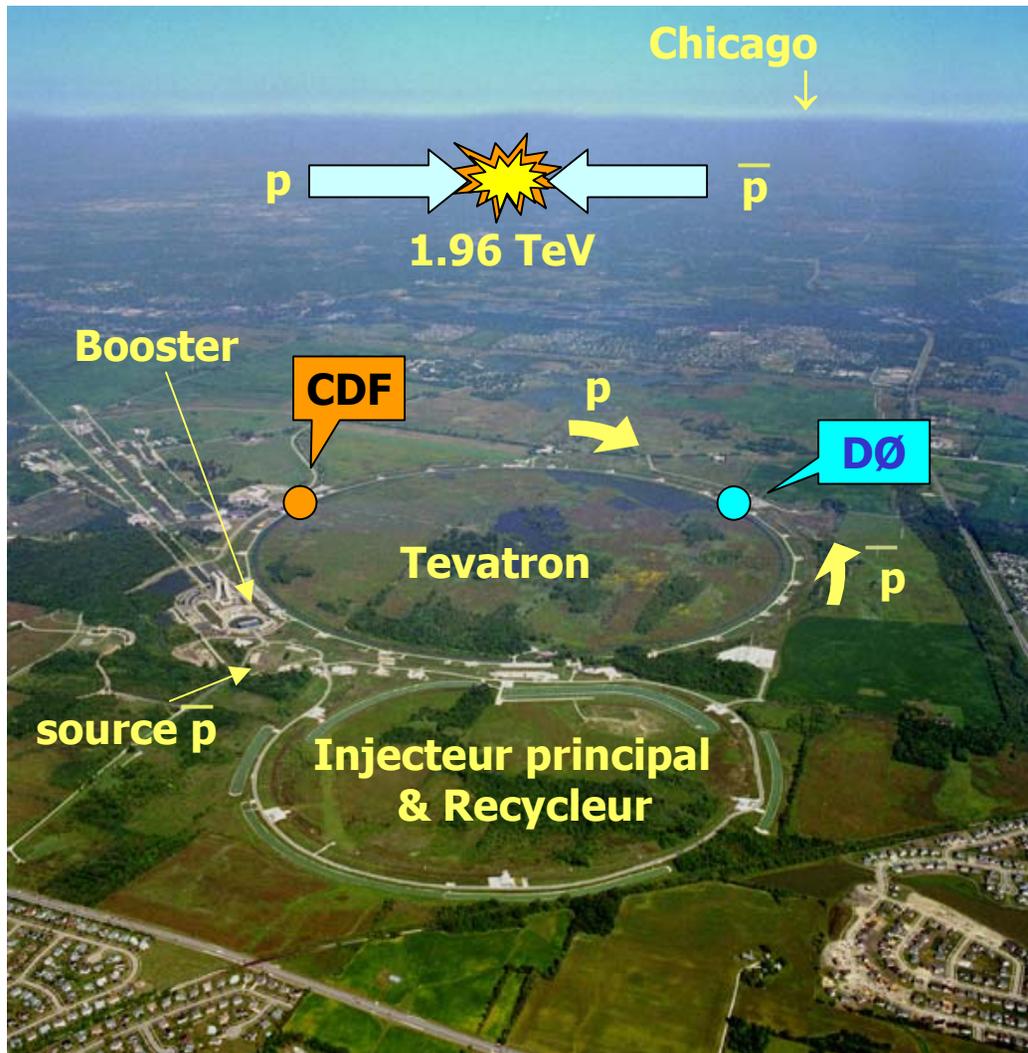
Jean-Claude Durand (Ingénieur informaticien 1999-2000)

Karim Errahmane (ATER 2001-2002)

Arnaud Lucotte (ATER 2000-2001) **Groupe OPERA LAL**

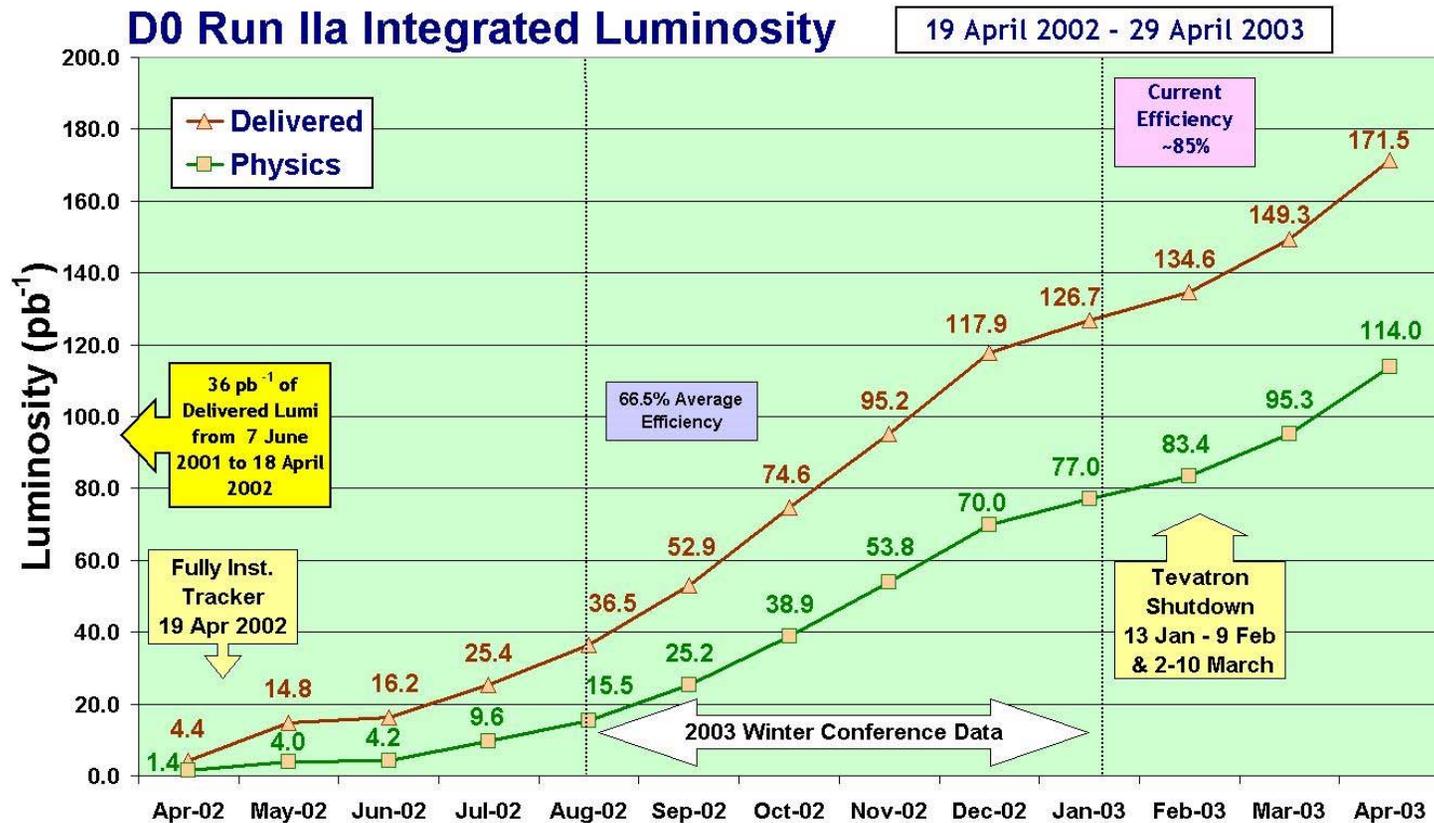
Nirmalya Parua (VE 1999-2000) **Groupe D0 Stony Brook**

Le collisionneur Tevatron au Fermilab



La prise de données

Luminosité intégrée totale : 175 pb⁻¹ (Run 1: 140 pb⁻¹)
par semaine : 6 pb⁻¹ (3x mieux qu'au Run 1)
au pic : 4 x 10⁺³¹ (2x mieux qu'au Run 1)
Efficacité d'acquisition : 86% actuellement



La prise de données : ...la 'photo' de la semaine dernière

D0 Data Taking for Week of Apr 28-May 4 2003

Last week D0 recorded 13.3 million physics events. 6.7 pb⁻¹ of luminosity was written to tape with the full detector in the readout.

Our physics data taking efficiency was 85.1%.

	Rec Lumi (pb ⁻¹)	Phys Evts (M)	Efficiency	Store (hrs)
Week 28 Apr-4 May	6.7	13.3	85.1%	101.3
Week 21-27 Apr	3.0	6.6	86.3 %	49.0
Week 14-20 Apr	6.0	13.3	87.0 %	110.3

The Tevatron delivered stores with initial D0 Luminosities of:

- Store 2491 @2.74E31 (18:23 Apr 28)
- Store 2495 @3.26E31 (03:25 Apr 30)
- Store 2502 @4.03E31 (00:04 May 02) New Record
- Store 2503 @3.77E31 (00:30 May 03)
- Store 2505 @3.90E31 (22:44 May 03)
- Store 2507 @3.60E31 (17:46 May 04)

4.03E31 : un record chasse l'autre!

Folder: GENERAL From : alstone@adsl-68-72-81-123.ds1.chcgil.ameritech.net
Subject: **New Run II Record D0 Luminosity = 4.03E31**
Date: 02-MAY-2003 07:02
Expires: 17-MAY-2003 07:02

**Run I
typical peak
1.6E31**

Store 2502 began at 00:04 CDT this morning (2 May 2003).

The initial D0 Luminosity was 4.03E31! This is an improvement over the previous record

of 3.95E31 from 20 March 2003 (Store 2328).

The Tevatron average was 4.24E31, also a record! CDF measured 4.44E31.

We began taking data within eight minutes of the declaration of store.

Our initial L1/L2/L3 output rates were 920/580/52 Hz.

First Run 176475 ran for four hours.

Alan

Le détecteur DØ amélioré

~100% opérationnel

Conçu pour reconstruire les électrons, muons, taus, les jets et l'énergie transverse totale, identifier les quarks b



Le détecteur D0 amélioré (suite)

Trajectographe interne : **traces chargées**

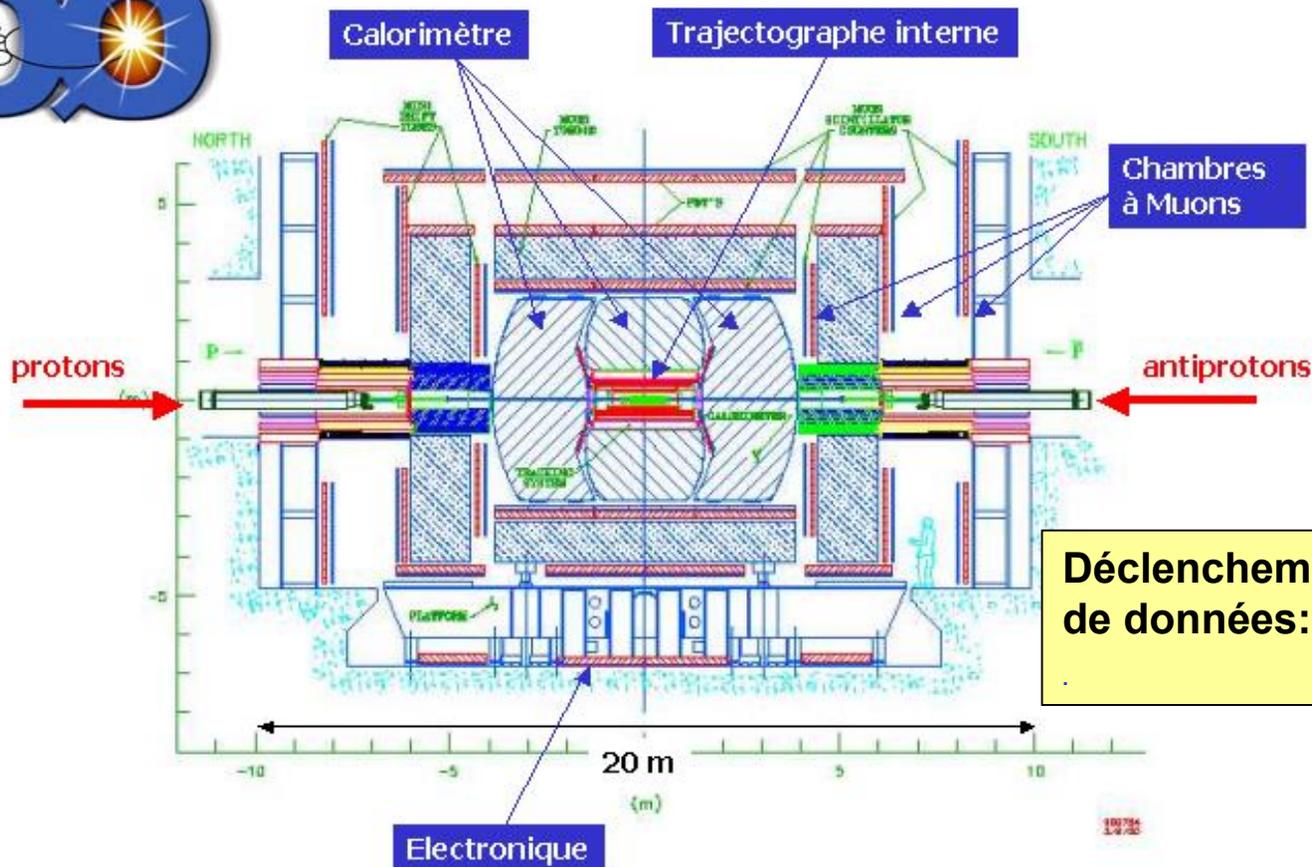
- 4 plans de détecteurs Si double face
- 8 couches de fibres scintillantes à lecture stéréo
- aimant supra solénoïdal de 2 T

Calorimètre Uranium - Argon liquide:

très **hermétique** et à fine granularité

identification : **jets, photons, électrons**

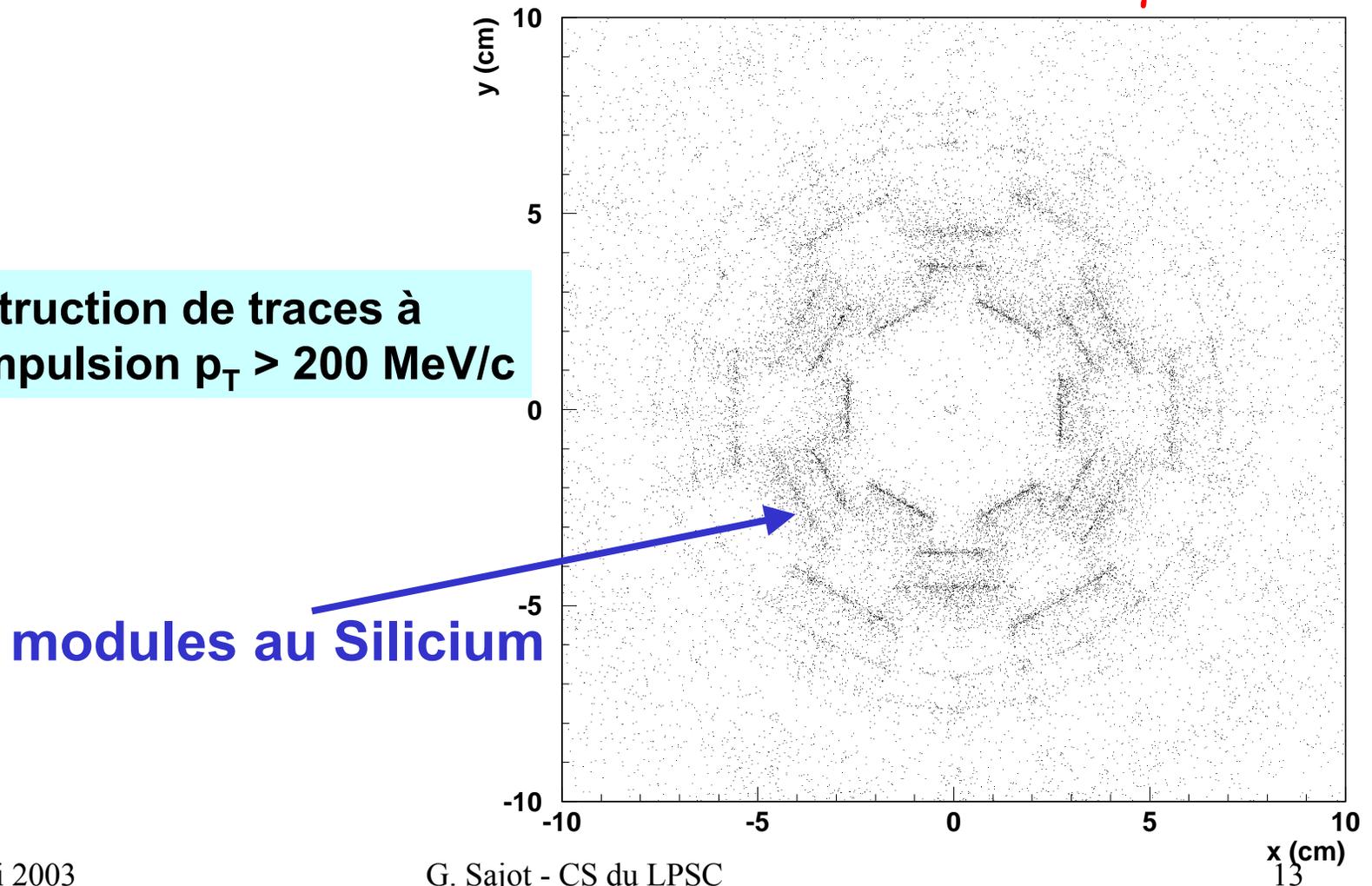
chambres à **muons** et 2nd aimant toroïdal



Déclenchement sélectif de la prise de données: **25 MHz à l'entrée**
→ **50 Hz à la sortie**

Le détecteur D0 amélioré (suite)

mesure des vertex $\gamma \rightarrow e^+e^-$



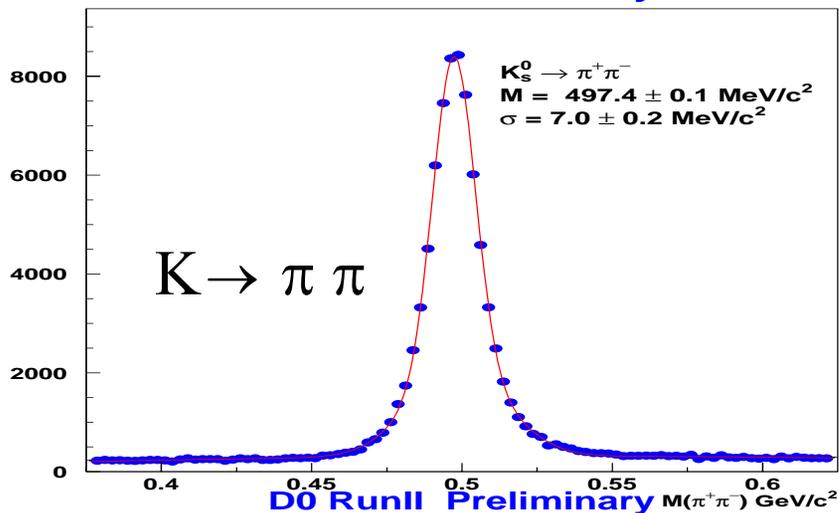


Quelques résultats Run II de D0

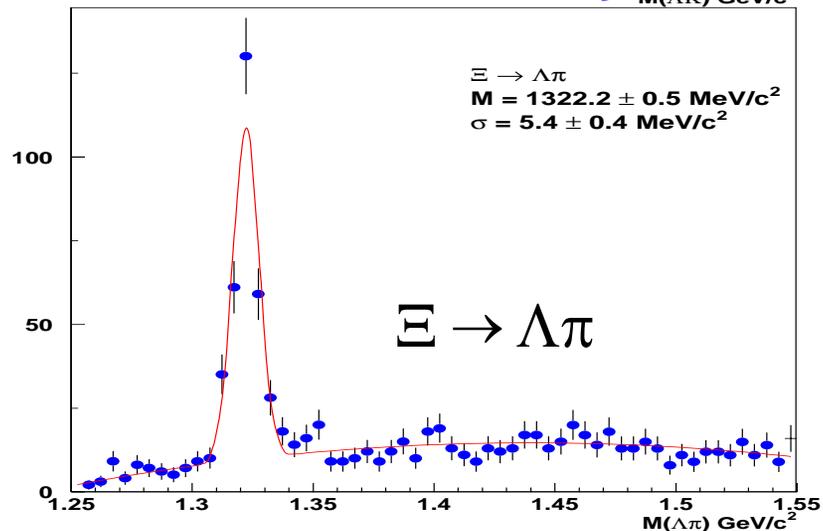
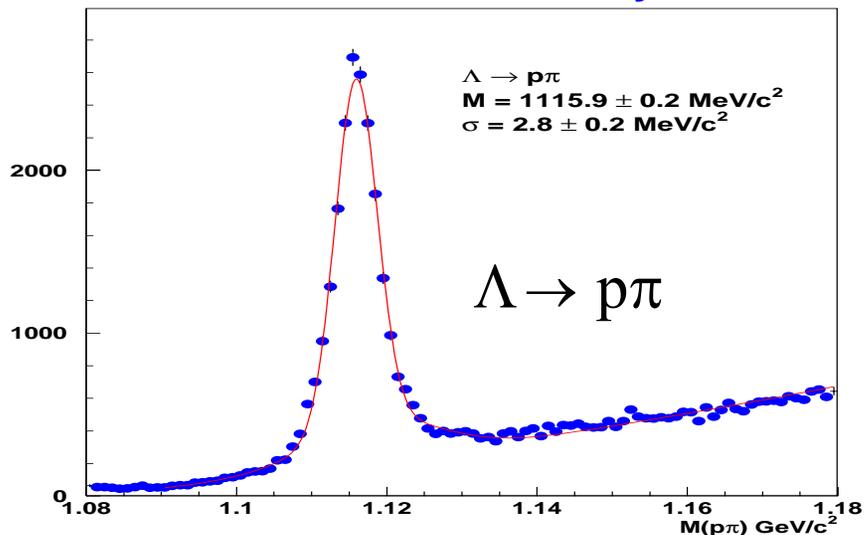
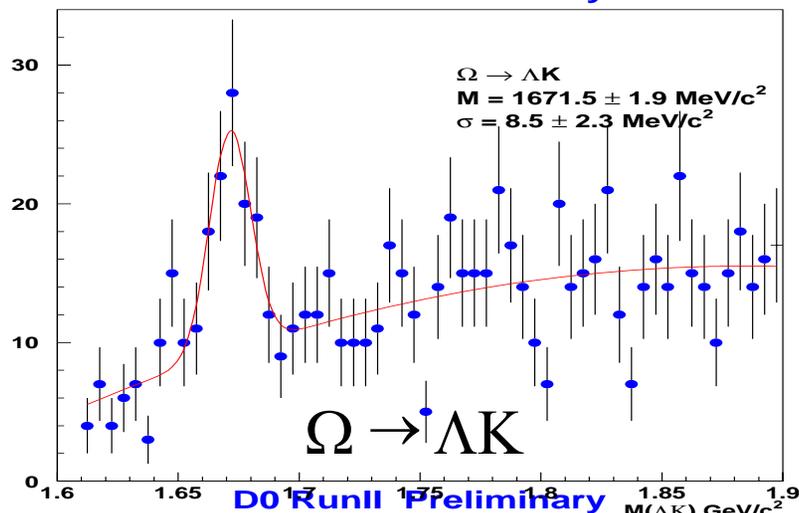


Observation de résonances

D0 RunII Preliminary

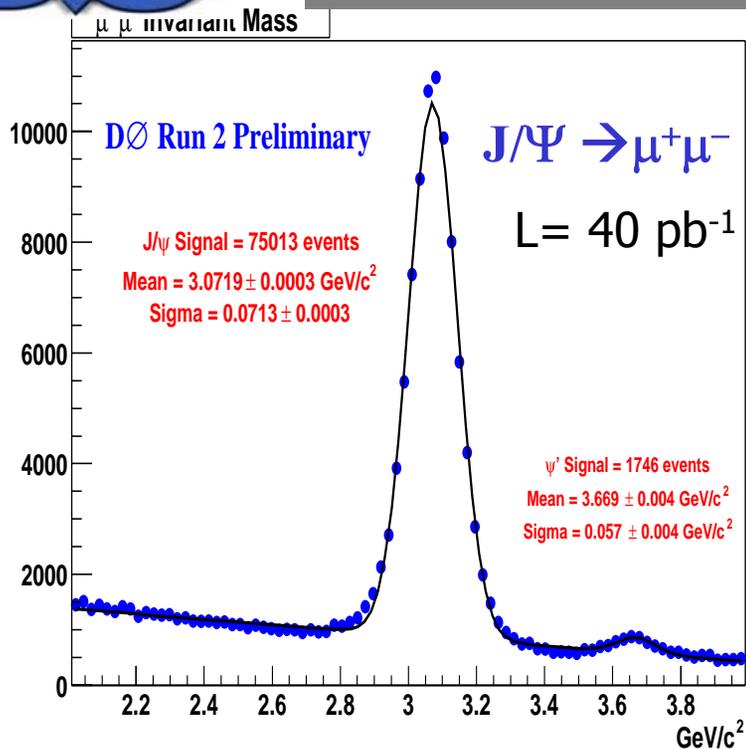


D0 RunII Preliminary

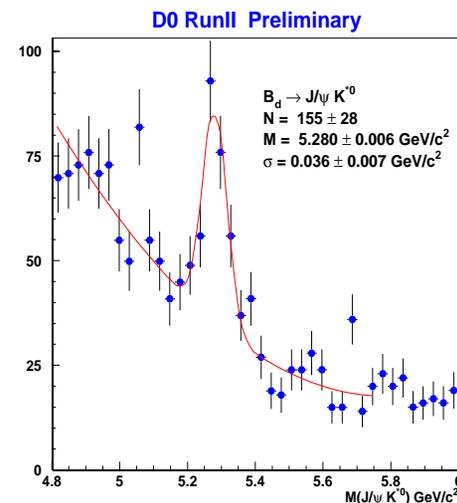
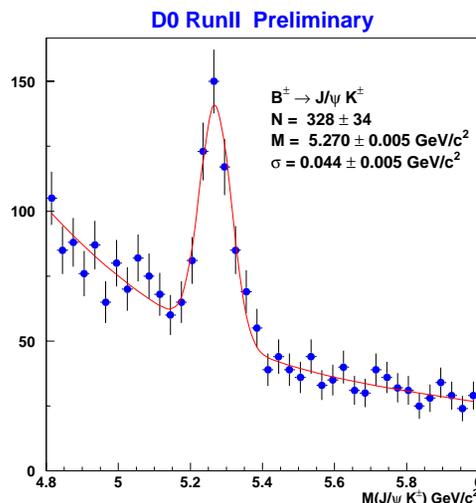




Reconstruction de mésons beaux

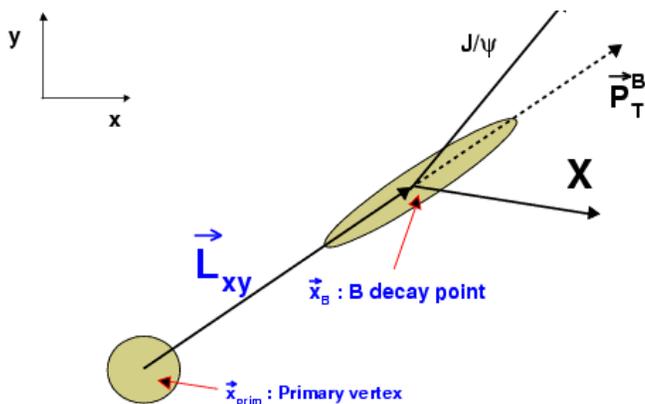


J/ψ combiné à une trace ou à un K^* et coupure sur la distance de vol



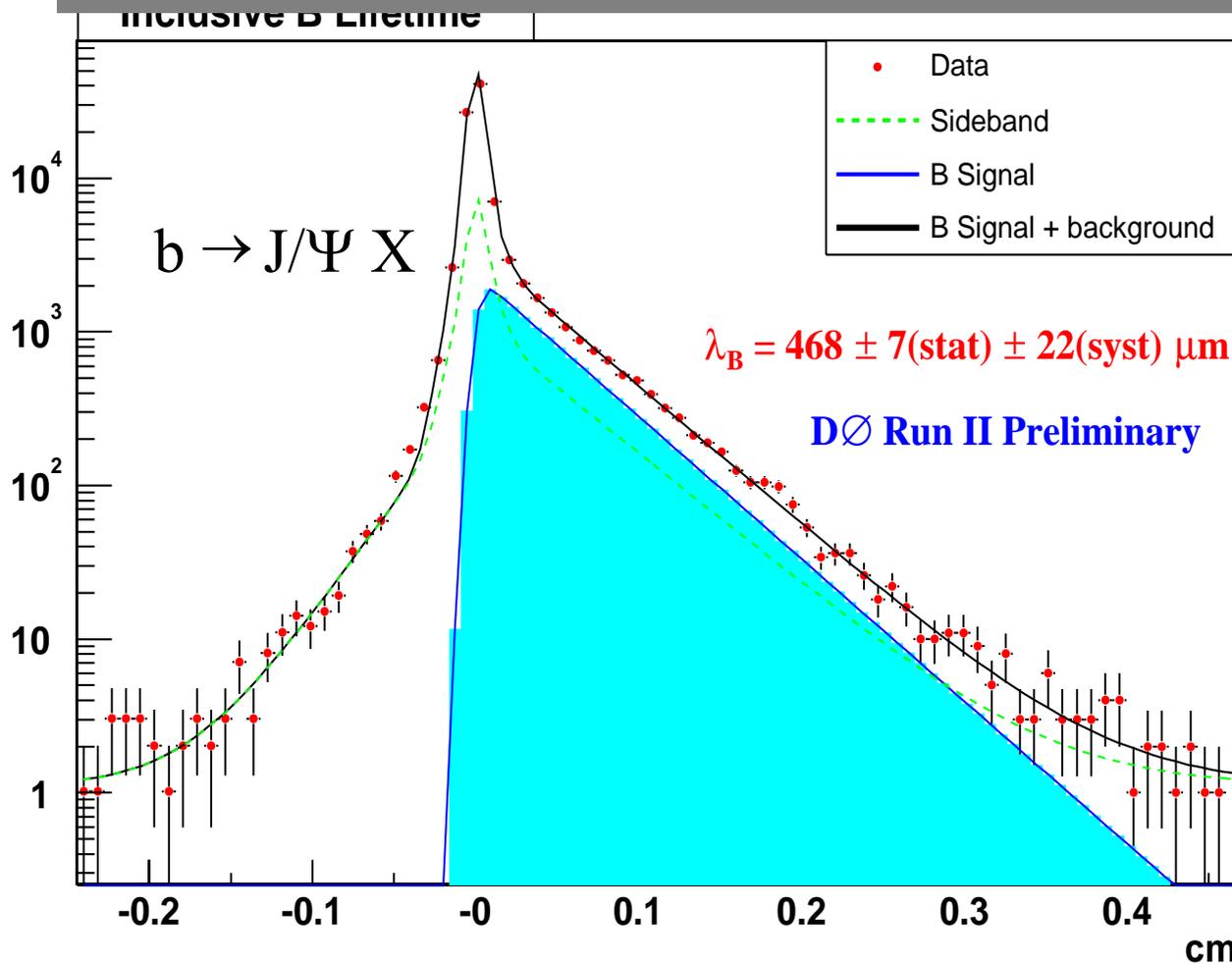
$B^+ \rightarrow J/\psi K^+$

$B_d \rightarrow J/\psi K^{*0}$





Durée de vie du B (inclusive)



$$\langle \tau \rangle = 1.561 \pm 0.024 \text{ (stat)} \pm 0.074 \text{ (sys)} \text{ ps}$$

$$\langle \tau \rangle = 1.564 \pm 0.014 \text{ ps (PDG)}$$

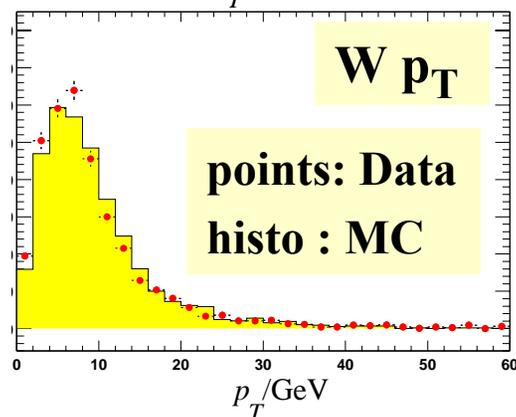
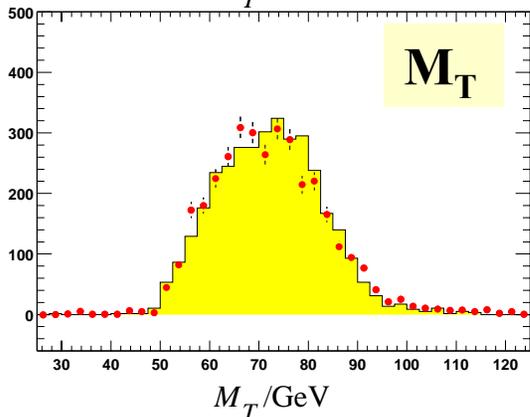
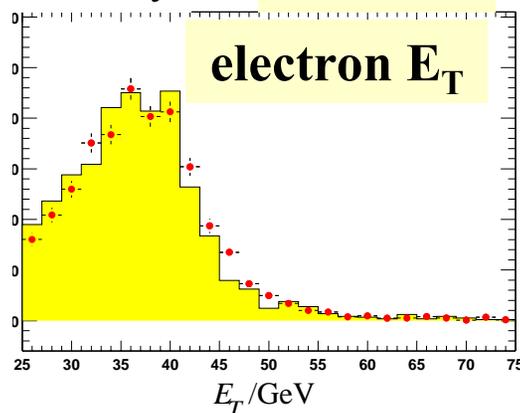
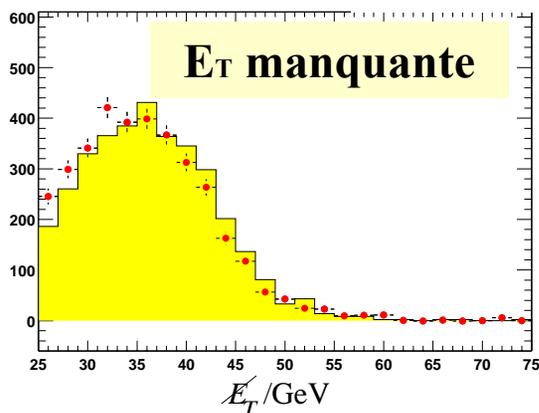


Reconstruction des bosons W et Z

- plusieurs milliers de $W \rightarrow e\nu$ et $W \rightarrow \mu\nu$ reconstruits
- pics de masse pour les $Z \rightarrow ee$ et $\mu\mu$

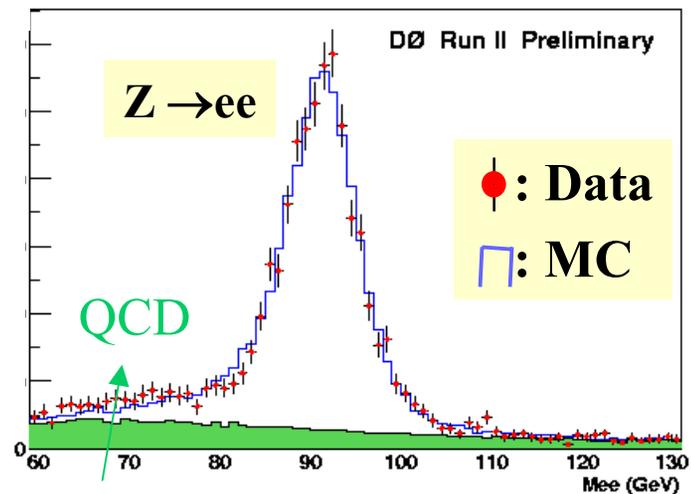
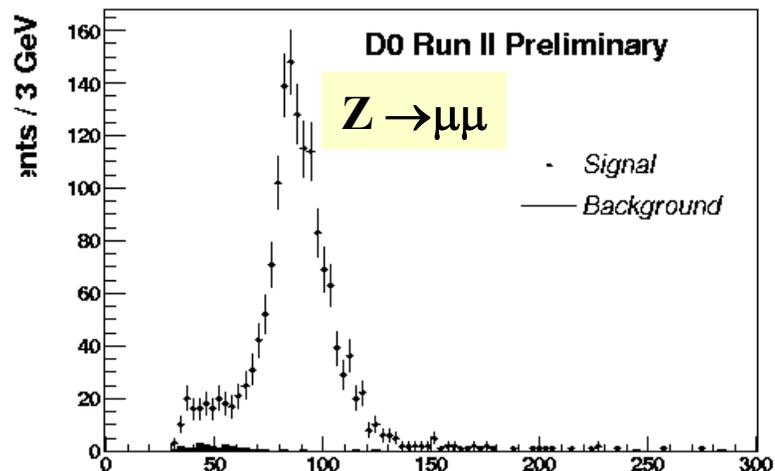
DØ RunII Preliminary

$W \rightarrow e\nu$



7 Mai 2003

G. Sajot - CS du LPSC





W, Z, top...

- **W & Z Cross Section measurements at root-S = 1960 GeV increased as predicted.**
- **A Z'(ee) search limited the mass (SM couplings) to > 620 GeV @ 95% c.l.**
- **Top Cross Section measured in 6 channels**

$$\sqrt{s} = 1.96 \text{ TeV}$$

$$\sigma(tt + X) = 8.4^{+4.5}_{-3.7} \text{ (stat)}$$

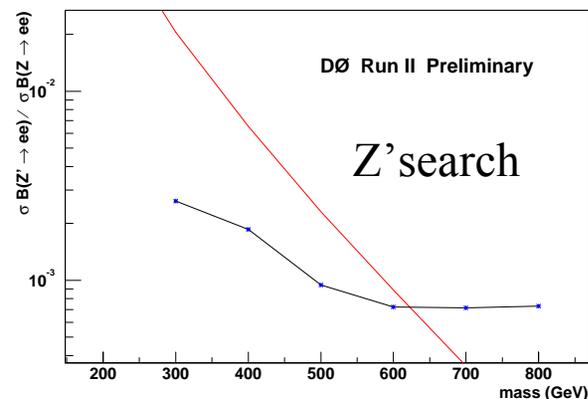
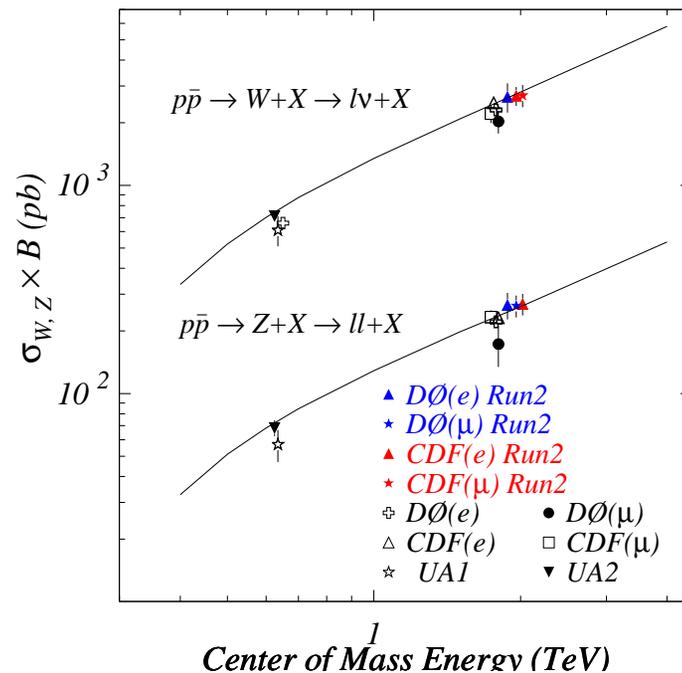
$$^{+5.3}_{-3.5} \text{ (syst)} \pm 0.8 \text{ (lum' y) pb}$$

- **New technique (promising for Run II) improved Run 1 Top Mass.**

Lep+Jets Result:

$$M_{\text{top}} = 179.9 \pm 3.6 \pm 6.0 \text{ GeV}/c^2$$

DØ and CDF Run2 Preliminary



Bilan du groupe D0-LPSC 1999-2003

- **Mesure de pureté de l'Argon liquide**
- **Identification de l'électron**
- **Étiquetage de b par électron près d'un jet**
- **Tests de SUSYGEN**
- **Recherche de particules supersymétriques en RpV**

Ref : <http://lpscwww.in2p3.fr> rubrique D0

Mesure pureté Ar : principe

A. Besson + G.S.
G. Bosson, Y. Carcagno,
G. Mondin + P. MARTIN

α

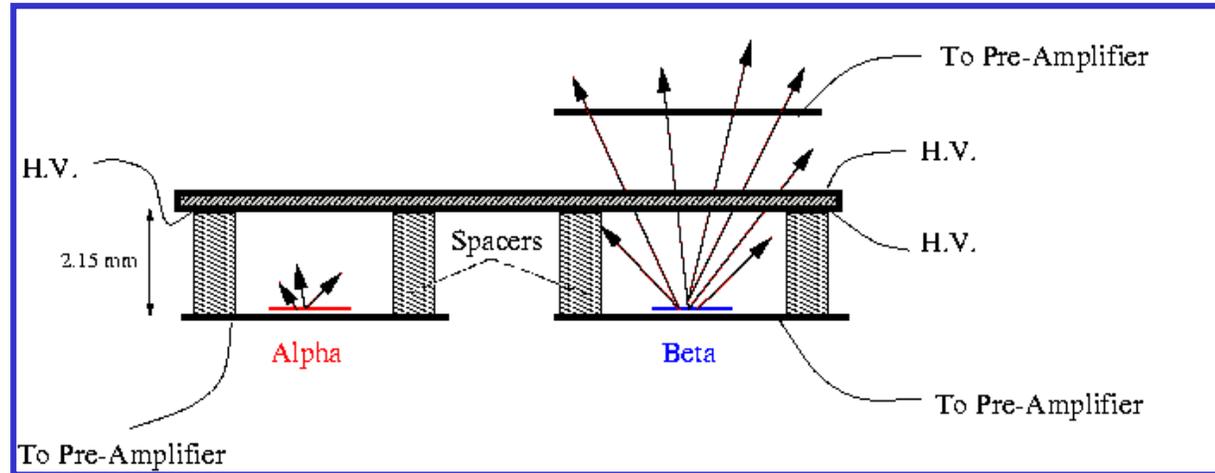
^{241}Am

5.5 MeV, T = 430 ans

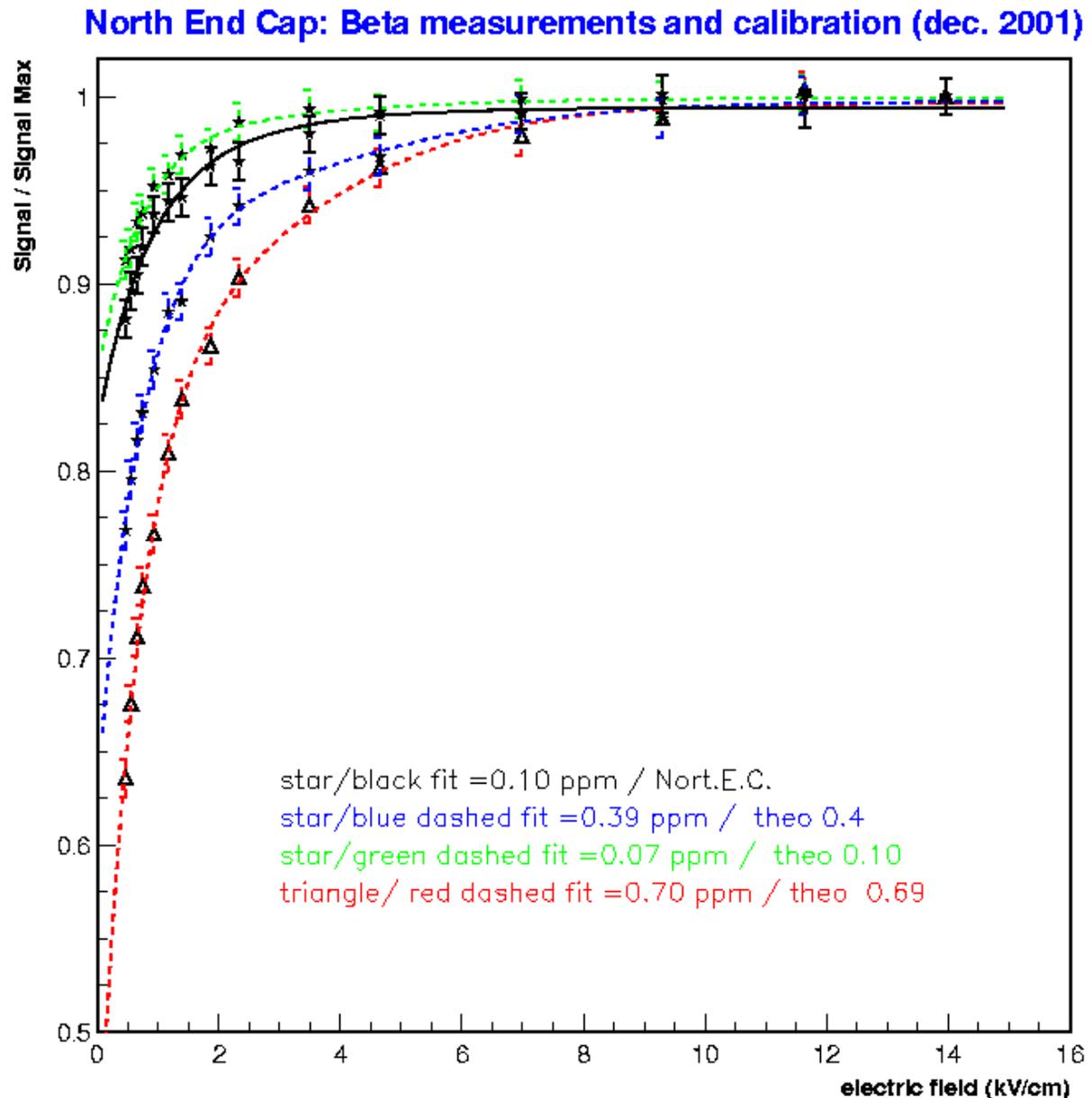
β

^{106}Ru

3.5 MeV, T = 1 an, 40kBq



- Sources électro-déposées sur une électrode en acier inoxydable.
- Sources immergées dans l'argon liquide (@ ~ 85 K).
- Ionisation et dérive des charges grâce à un champ électrique variable E .
- Espace entre les électrodes : $d = 2.15 \text{ mm}$.
- La charge collectée dépend de la pollution p et du champ E .

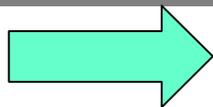


Contributions à l'identification de l'électron *non détaillées dans cette présentation*

- **code de reconnaissance globale (likelihood)** P. Demine
- **étude “faux électrons”:**
 - MC : pour likelihood K. Errahmane, A. Lucotte N. Parua
 - data : pour analyse O. Kouznetsov
- **études préliminaires d'un fit global des paramètres de l'électron (énergie, direction)** Y. Arnoud S. Crépe-Renaudin
- **Tests/responsabilité des programmes de reconstruction électromagnétique** S. Crépe-Renaudin
- **« Calorimeter Algorithms Task Force » = 7 experts (bruit, suppression de “0”, réponse EM, résolution, comparaison data/MC pour améliorations MC...)** J. Stark

Électron : corrections géométriques

S. Crépé-Renaudin
+A-M Magnan



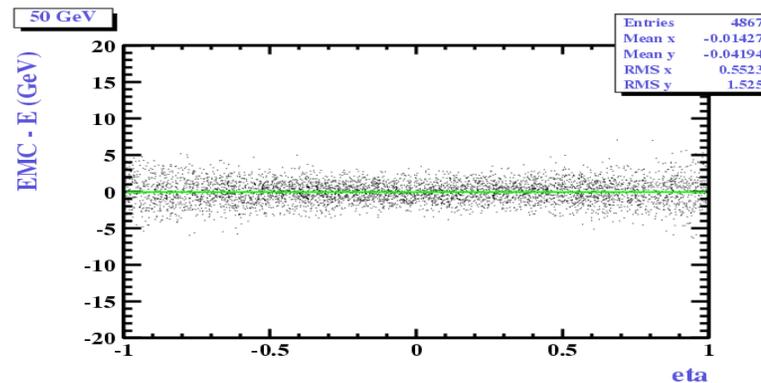
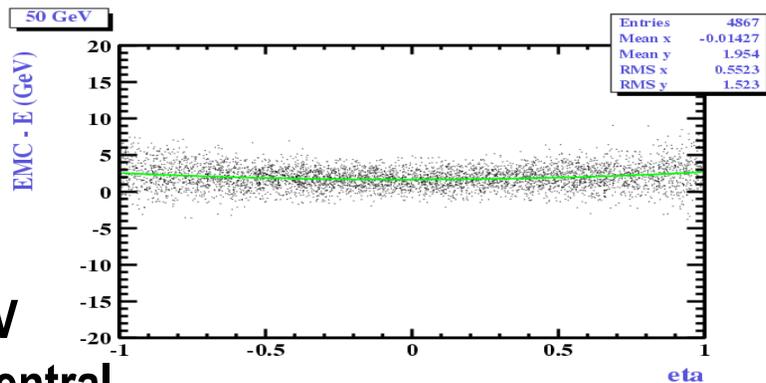
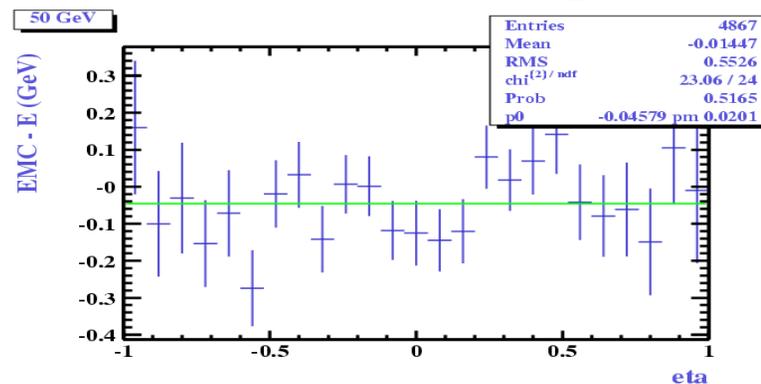
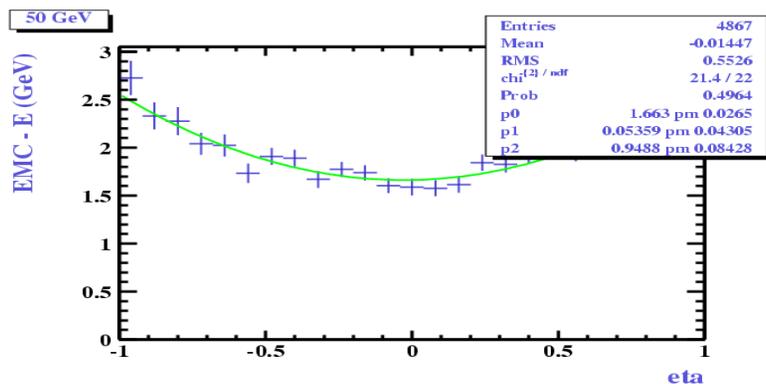
Corriger l'énergie en fonction de η et de E

$$E_{MC} - E_{reco} = p_0 + p_1 \cdot \eta + p_2 \cdot \eta^2$$

$p_i = \text{fonction}(E)$

avant cor

après cor



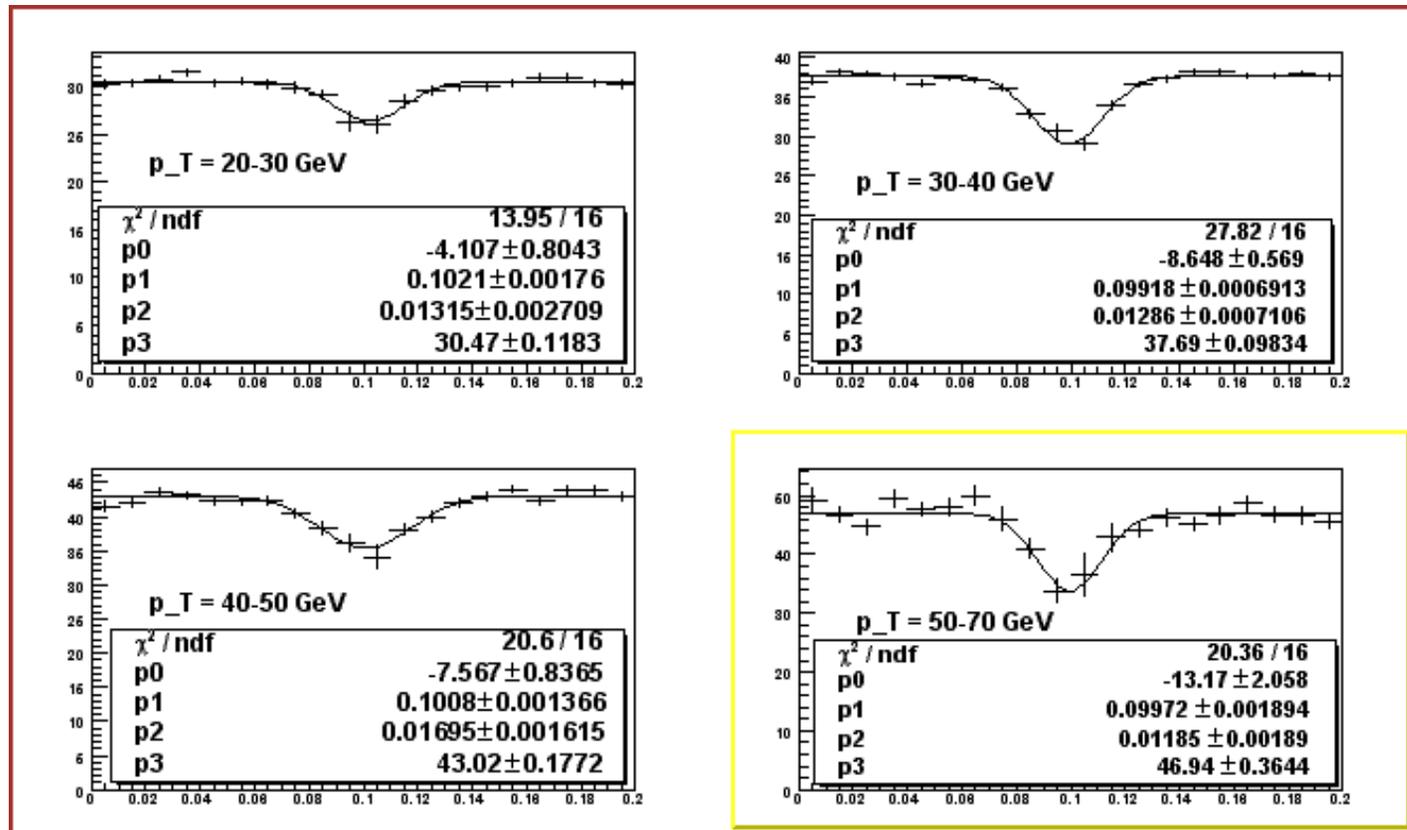
50 GeV
calo central

Corrections en énergie des e passant entre les cellules du Calorimètre ('cracks en ϕ ')

O. Kouznetsov

P13 DATA : energy losses of electrons from Z (mass [75-105] GeV) + W (mass [40-90] GeV) peaks

cracks $\phi = 30\%$!



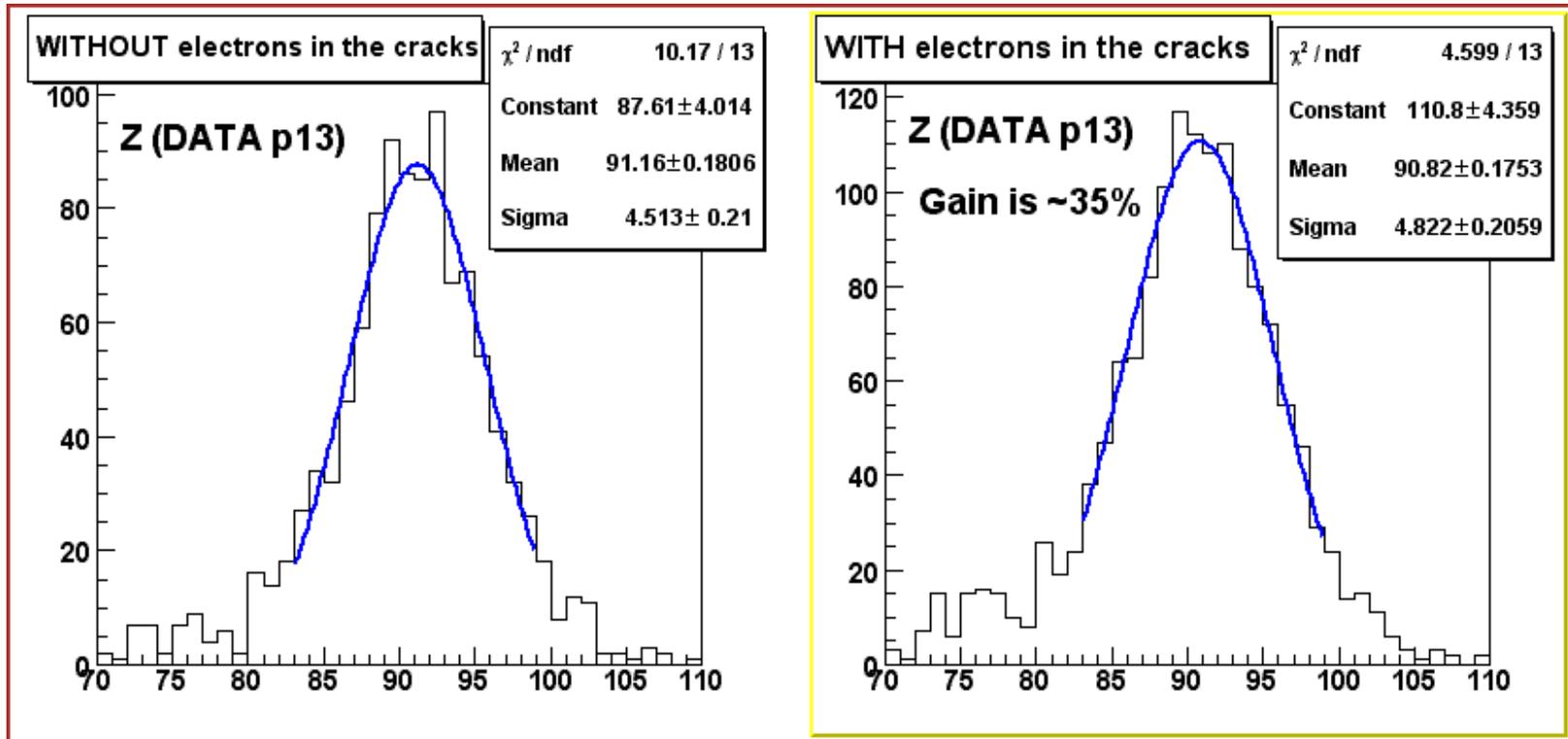
en abscisse : ϕ modulo $2\pi/32$

Effet des corrections 'cracks en ϕ ' : Z

O. Kouznetsov

pas de e
dans 'cracks'

avec e
dans 'cracks'



Les 2 électrons sont associés à des traces

Doit être remesurée car nouveaux matériaux devant le calo (tracker, bobine supra)

Méthode : on ajuste les paramètres de résolution (C,S,N) en comparant le pic du Z(ee) MC au pic obtenu dans les données (on tient compte aussi de la résolution en théta et phi du trajectomètre)

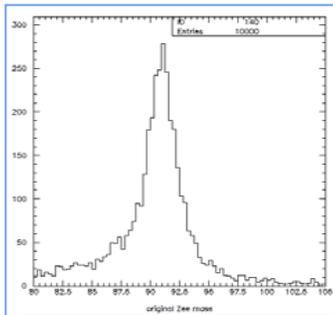
$$\left(\frac{\sigma_E}{E}\right)^2 = C^2 + \frac{S^2}{E} + \frac{N^2}{E^2}$$

Run I

Noise term = 0.29
Sampling term = 0.157
Constant term = 0.003

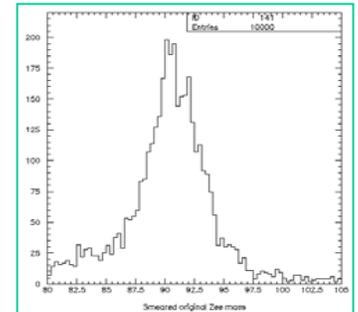
$$M \approx \sqrt{2E_1E_2(1 - \cos\theta)}$$

$$M_{smeared} \approx \sqrt{2E_{1s}E_{2s}(1 - \cos\theta_s)}$$



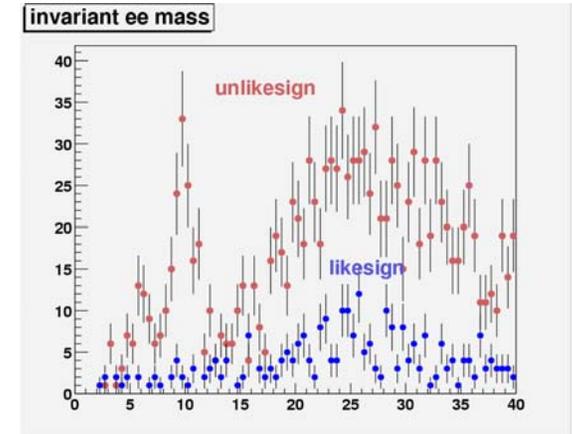
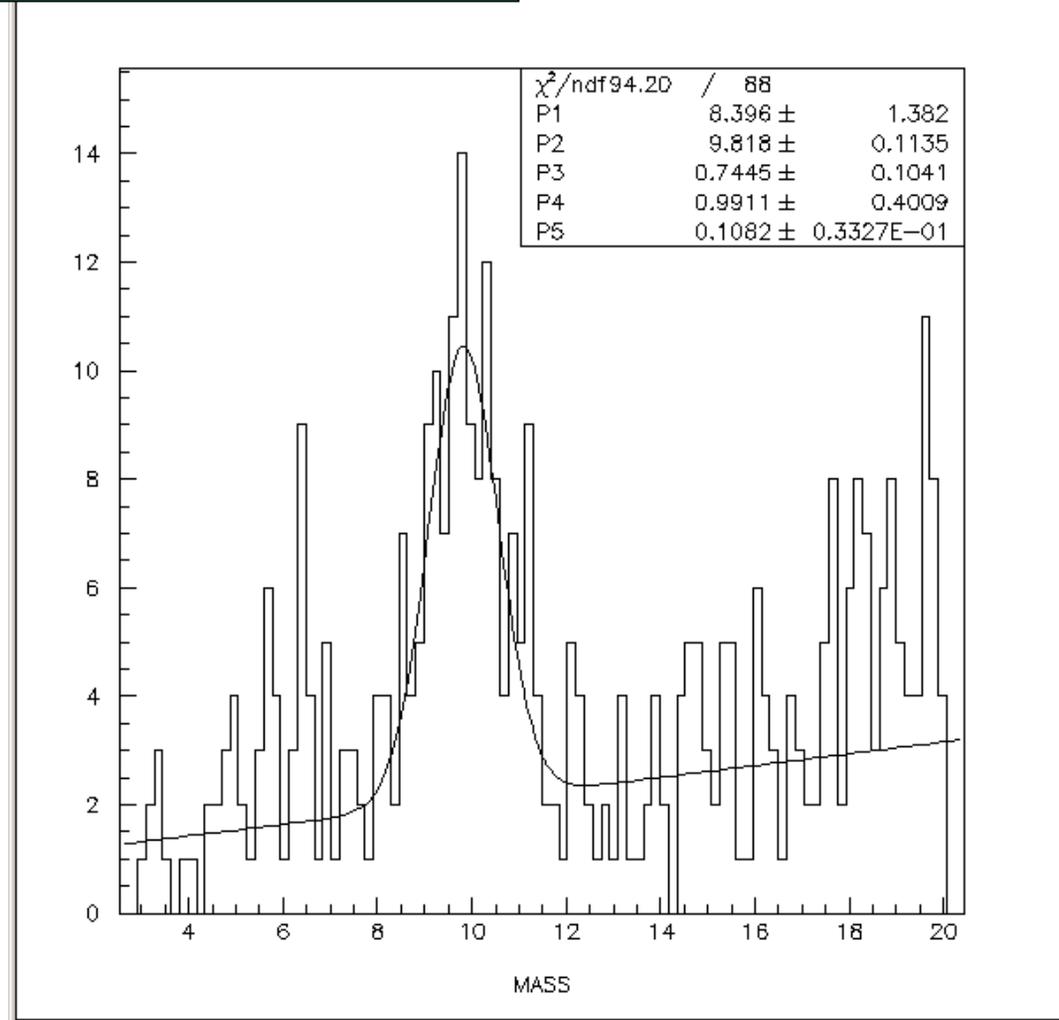
theta and phi
tracker resolution
from single e full simulation
p13.06.01

Theta and phi resolutions has to be carefully cross checked (to do list)



Résolution du calorimètre : largeur du Upsilon(ee)

$$\Gamma_T = 750 \pm 100 \text{ MeV}$$



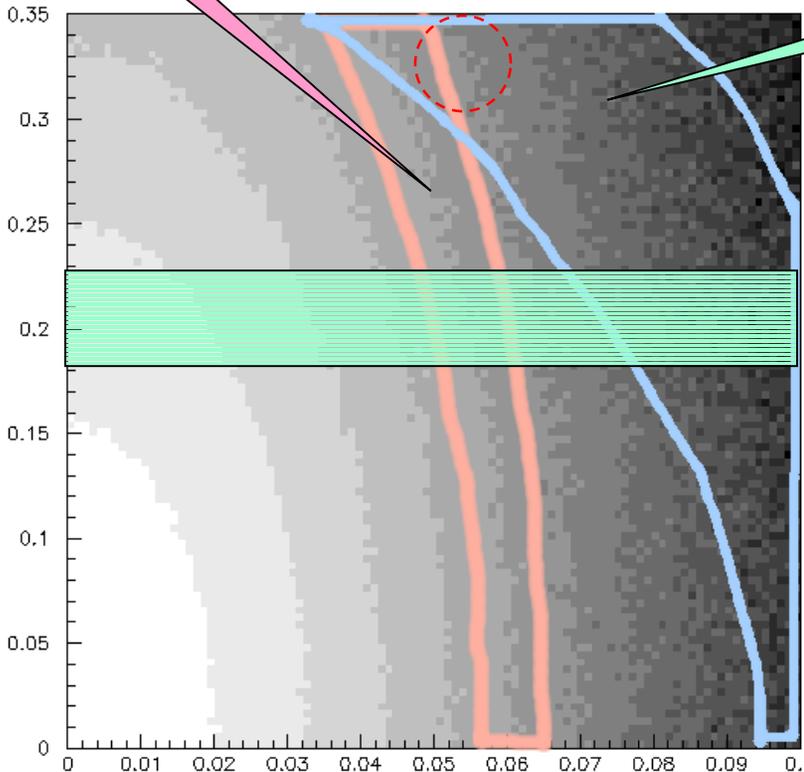
événements sélectionnés
par Ulla Blumenschein
(groupe Freiburg)

Résolution du calorimètre : largeurs Z et Upsilon (ee)

Y.Arnoud

Z

Upsilon



Two solutions to explain discrepancy :

- Noise term is very different than 0.29
- Sampling term has increased

With the present data set, we can roughly estimate that :
 $S \sim 0.3$ and $C \sim 0.055$

Those numbers are very preliminary

**Une des tâches prioritaires
du groupe emid de D0**

Assuming Noise = 0.29
and $0.15 < \text{Sampling} < 0.20$
There is no 1 sigma overlap region !

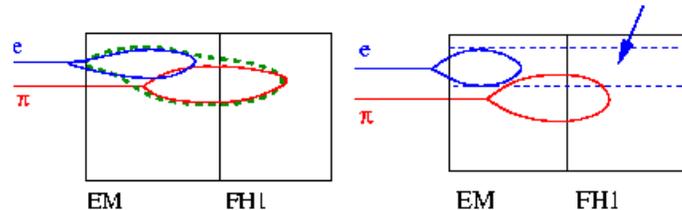


**Résonances de basse
masse très importantes**

Identification de l'électron près d'un jet

J. Stark

Clusterisation standard



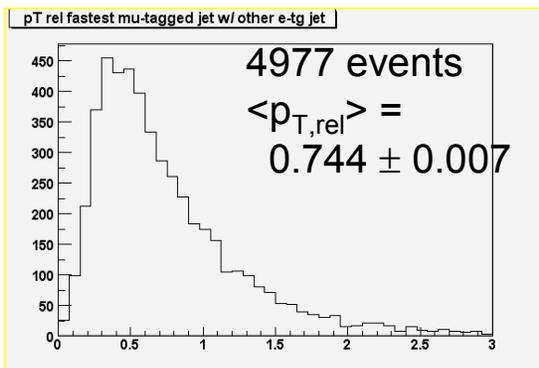
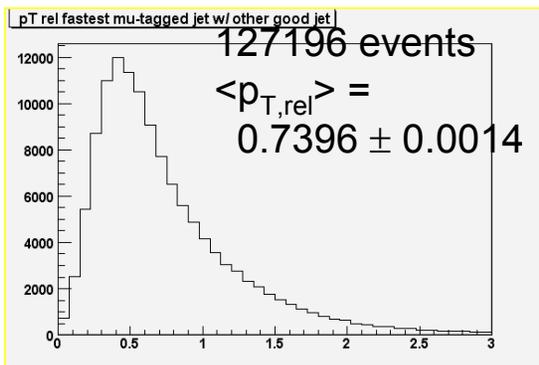
route

- **Algorithme initialement développé par F. Beaudette et J-F. Grivaz (groupe D0-LAL)**
- Certification sur les nouvelles “releases”
- Améliorations
- Estimation de l'efficacité (par exemple $J/\Psi \rightarrow e^+e^-$)
- Étiquetage de b
- Trigger L3 électron bas p_T

Application à l'étiquetage de b dans les données

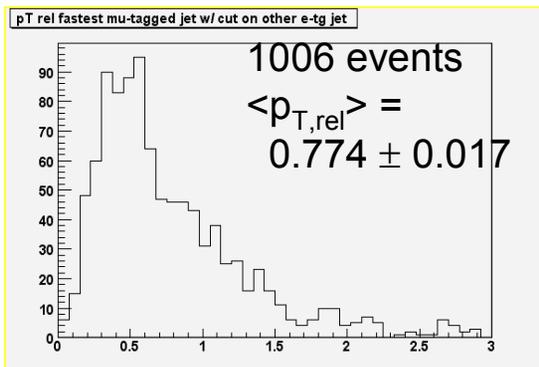
1 jet étiqueté avec un μ et au moins un 'bon' second jet

$$\Rightarrow f_{bb} = 0.374$$



+ 1 électron associé au second jet

$$\Rightarrow f_{bb} = 0.387 \pm 0.023 \text{ (stat, data)} \pm 0.119 \text{ (stat, } \mu \text{ MC)}$$



+ 1 électron de $p_{T,rel} > 1$ associé au second jet

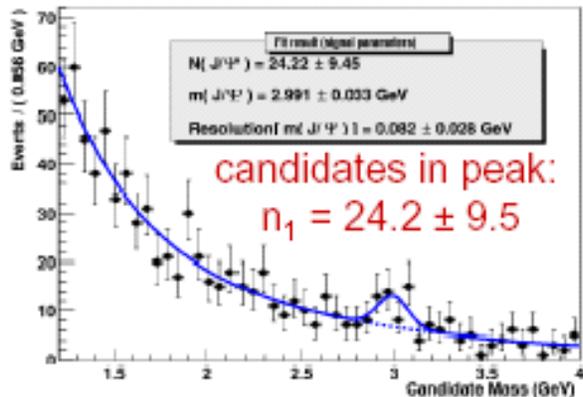
$$\Rightarrow f_{bb} = 0.485$$

Nécessité de distributions en Pt du fond
Étude du biais des échantillons MC

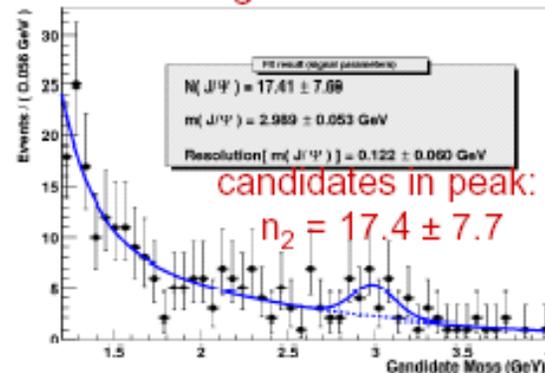
J. Stark

Pairs of electrons from the decay of low-mass resonances (J/Ψ , Y , ...) are a useful tool to study the calorimeter response at low energies. We have the tools to reconstruct these decays, but we obtain very poor event yields because we do not have a trigger for these decays.

one tight + one loose electron



two tight electrons



Goal: low- p_T di-EM triggers based on CEM terms only have proven to be difficult to implement (high L1 rates). Use, in addition, CTT information at L1.
Once di-EM candidates have been triggered using tracks and EM energy deposits at L1, it seems natural to use the L3 Road method to achieve further background rejection at L3.

Mesure de l'efficacité d'identification des e de bas p_T

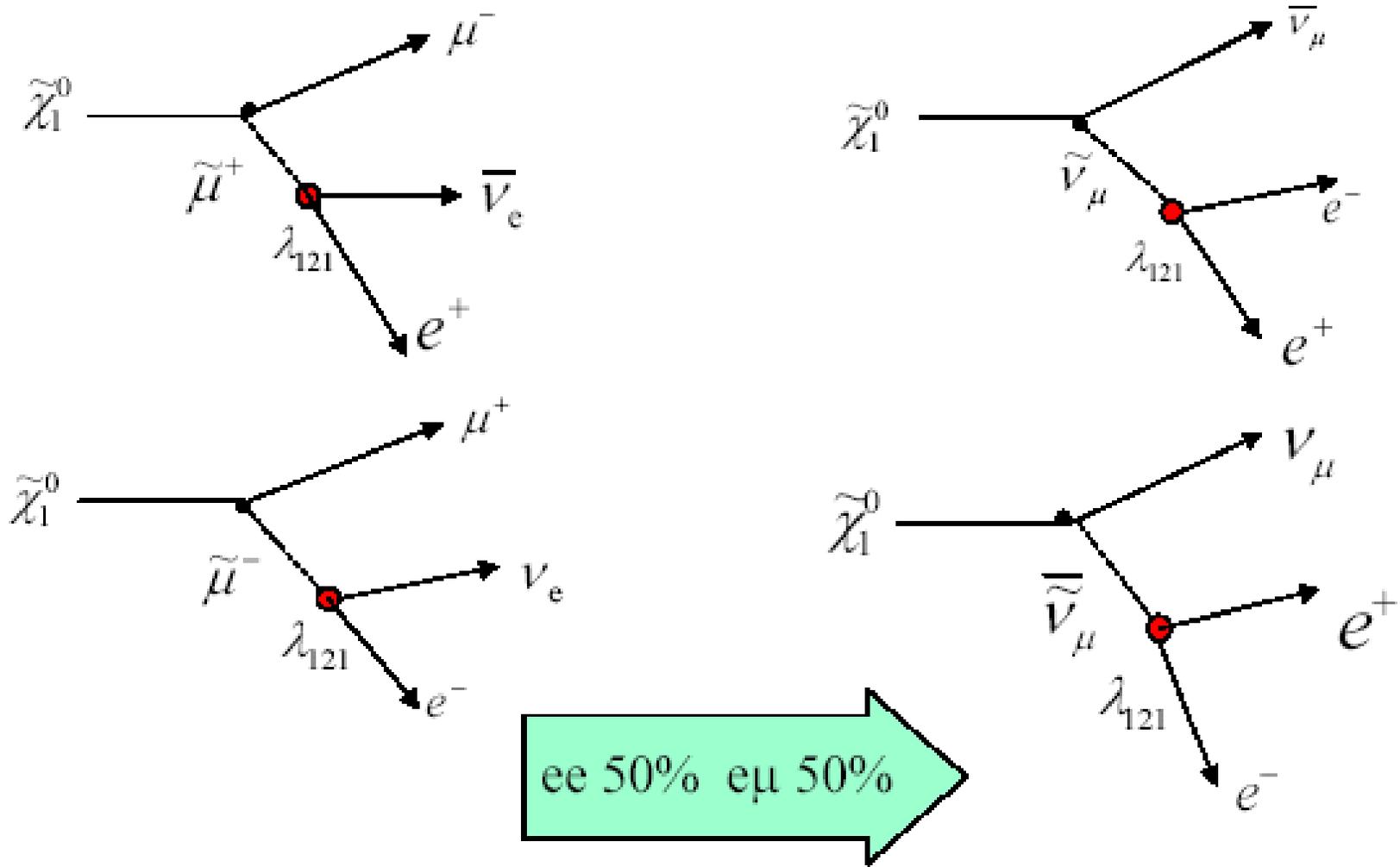
Recherche de particules SUSY RpV

Y. Arnoud, A. Besson
P. Demine, A-M Magnan
G. S.

- **Dans la continuation des analyses DELPHI**
- **Collaboration avec D0 Saclay pour SUSYGEN et simulation "rapide"**
- **Une grande luminosité n'est pas nécessaire pour améliorer les résultats du Run I et du LEP**
- **Couplages λ et λ' : Etats finaux « relativement faciles » : leptons**

SUSY RpV exemple avec couplage λ_{121}

A-M Magnan



SUSY RpV : analyse en cours λ_{121}

A-M Magnan

Cuts applied	Selection efficiency (%)			
	m_0 150 m_{12} 150 $\mu < 0$	m_0 500 m_{12} 100 $\mu < 0$	m_0 150 m_{12} 150 $\mu > 0$	m_0 500 m_{12} 100 $\mu > 0$
Id, kinem, 2 track match	19.1	12.9	18.3	7.7
$10 < ee \text{ mass} < 70 \text{ GeV}$	13.8	10.8	13.9	7.2
$M_t > 15 \text{ GeV}$	12.4	9.1	12.4	6.0
addTrack pt > 5, $ \eta < 3$	11.8	8.6	11.9	5.4
$E_T > 15 \text{ GeV}$	10.1	6.0	9.4	2.8
Add 3 rd electron pt > 5.	4.9	3.0	4.6	1.7
Add 3 rd muon pt > 5.	2.2	1.1	2.0	0.5

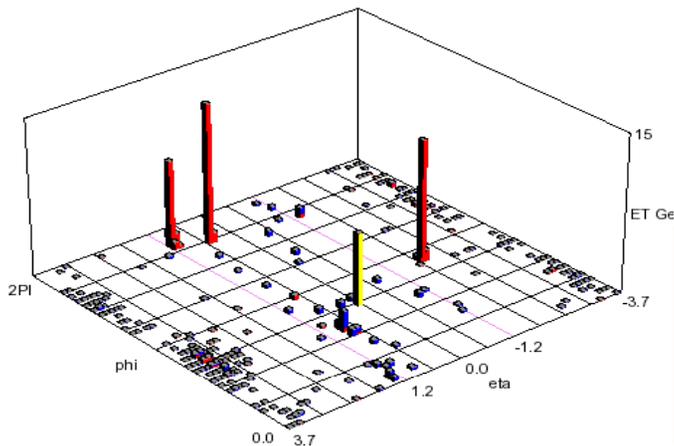
Efficacités 2 à 3 fois supérieures à R-parité Conservée

SUSY RpV : sélection “ λ_{121} ”

P.Demine

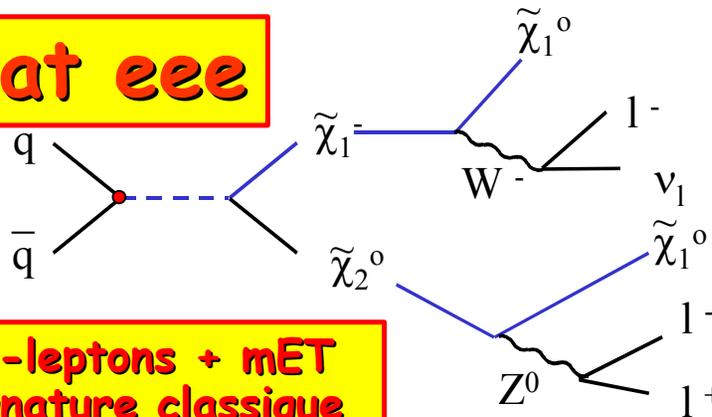
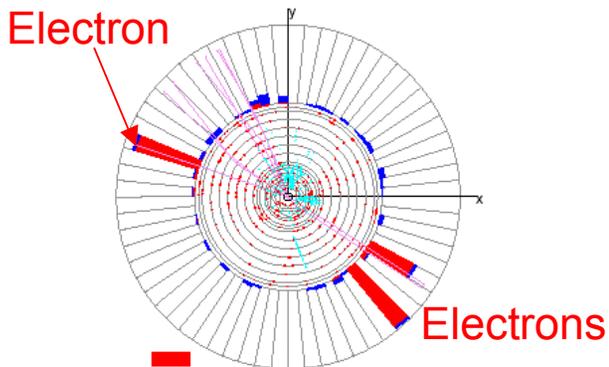
DØ Run 2 Preliminary

candidat eee



Run 143440 Event 11104009 Thu Feb 28 09:11:12 2002

ET scale: 15 GeV



**Les evts 3-leptons + mET
sont une signature classique
pour la SUSY
“golden channel”**

e1	e2	e3
$E_T = 17.9 \text{ GeV}$	$E_T = 13.9 \text{ GeV}$	$E_T = 13.2 \text{ GeV}$
$p_T = 0.52 \text{ GeV}$	$p_T = 10.9 \text{ GeV}$	$p_T = 15.1 \text{ GeV}$
$\eta = 0.43$	$\eta = -1.94$	$\eta = 1.06$
$\varphi = 5.42$	$\varphi = 2.80$	$\varphi = 5.72$
Charge = +1	Charge = +1	Charge = -1
$m_{e1e2} = 55.7$	$m_{e1e3} = 10.8$	$m_{e2e3} = 63.5$
$m_{e1e2e3} = 85.2 \text{ GeV}/c^2$		$ME_T = 10.7 \text{ GeV}$

Demande de continuation au-delà de 2003

- Quelle luminosité et pour quelle physique au Tevatron ?
- Quelles analyses pour le groupe D0-LPSC?

Luminosité et potentiel de physique de CDF/D0

● 2fb⁻¹

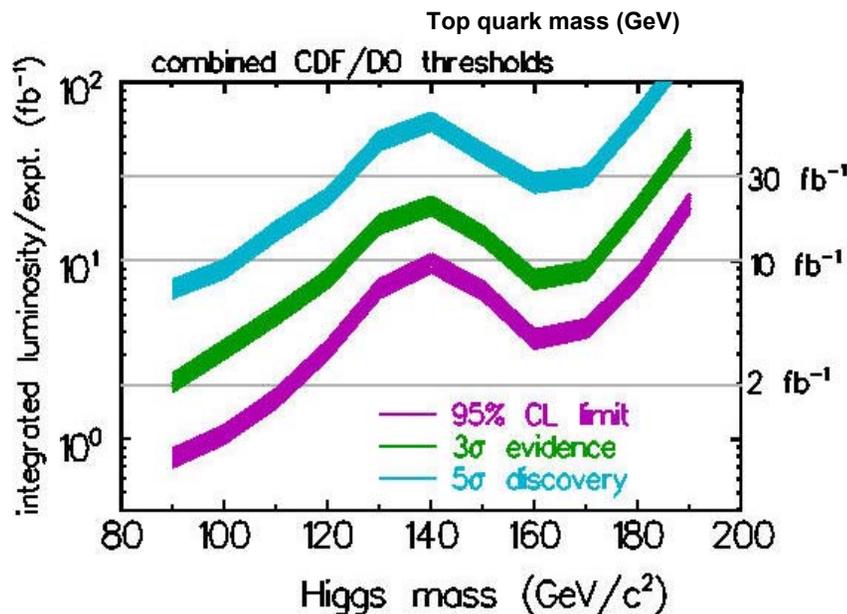
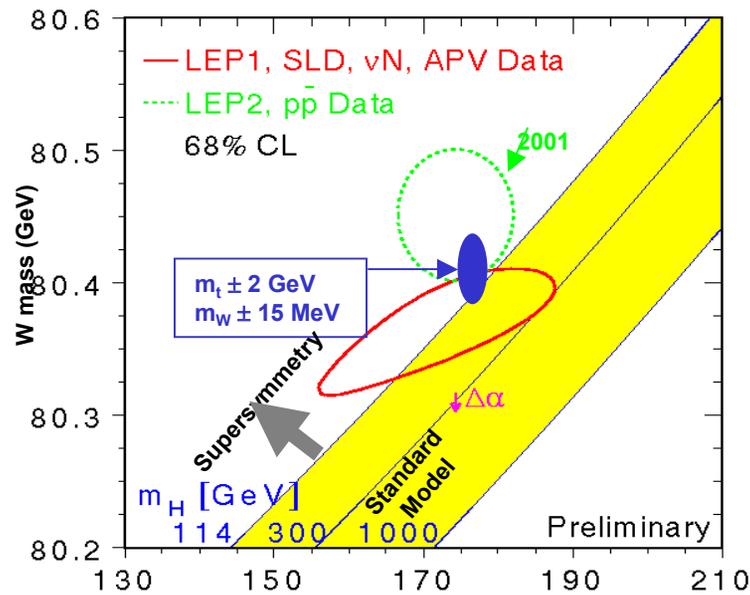
- Measure top mass ± 3 GeV
- Measure W mass ± 15 MeV
- Directly exclude $m_H = 115$ GeV
- SUSY Higgs search @ large $\tan \beta$
- Constrain the CKM matrix

● 5 fb⁻¹

- 3 σ Higgs signal @ $m_H = 115$ GeV;
- exclude Higgs 115-125, 155-175 GeV
- exclude much of SUSY Higgs parameter space
- possible discovery of supersymmetry in very large fraction minimal SUSY parameter space

● 10 fb⁻¹

- 3 σ Higgs signal $m_H = 115$ -125, 155-175 GeV;
- exclude Higgs over whole range 115-175 GeV
- possible discovery of supersymmetry in larger fraction of parameter space



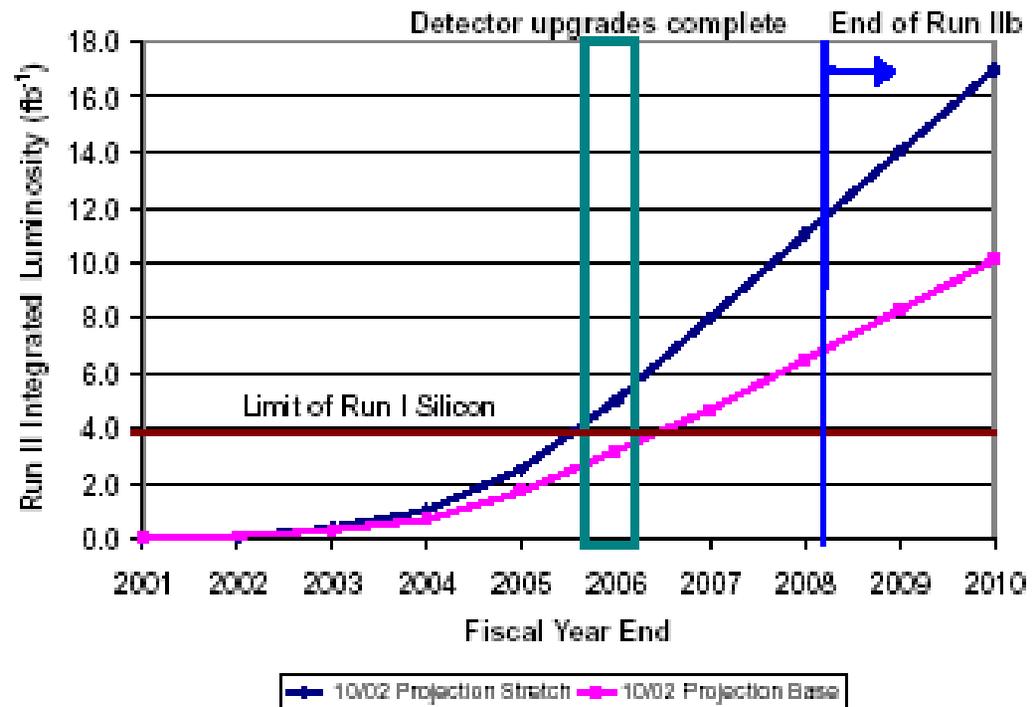
Quelle luminosité pour le futur?

■ Luminosity projections throughout Run II

- We have done detailed studies of technical issues to be addressed.

■ Caveats

- R&D is still going on.
- Detailed schedule and resource planning is still needed.
- Funding is not known.



Ref : M. Witherell Directeur du FNAL meeting HEPAP 7 novembre 2002

http://www.fnal.gov/directorate/hepap_1102%20.pdf

fiscal year - The fiscal year is designated by the calendar year in which it ends; for example, fiscal year 2003 begins on October 1, 2002 and ends on September 30, 2003.

Que souhaite faire le groupe D0-LPSC?

Analyser les 5fb-1 attendus d'ici fin 2006 en utilisant son savoir faire sur :

- l'identification de l'électron
- l'étiquetage du b (par électron)

Pour :

- **continuer l'analyse SUSY RpV**
(thèse Anne-Marie Magnan - 2005)
- **contribuer à l'étude du top et production « single »**
(thèse Gwenaël Le Gorrec - 2006)

...et continuer d'assurer les tâches techniques dont nous avons la responsabilité

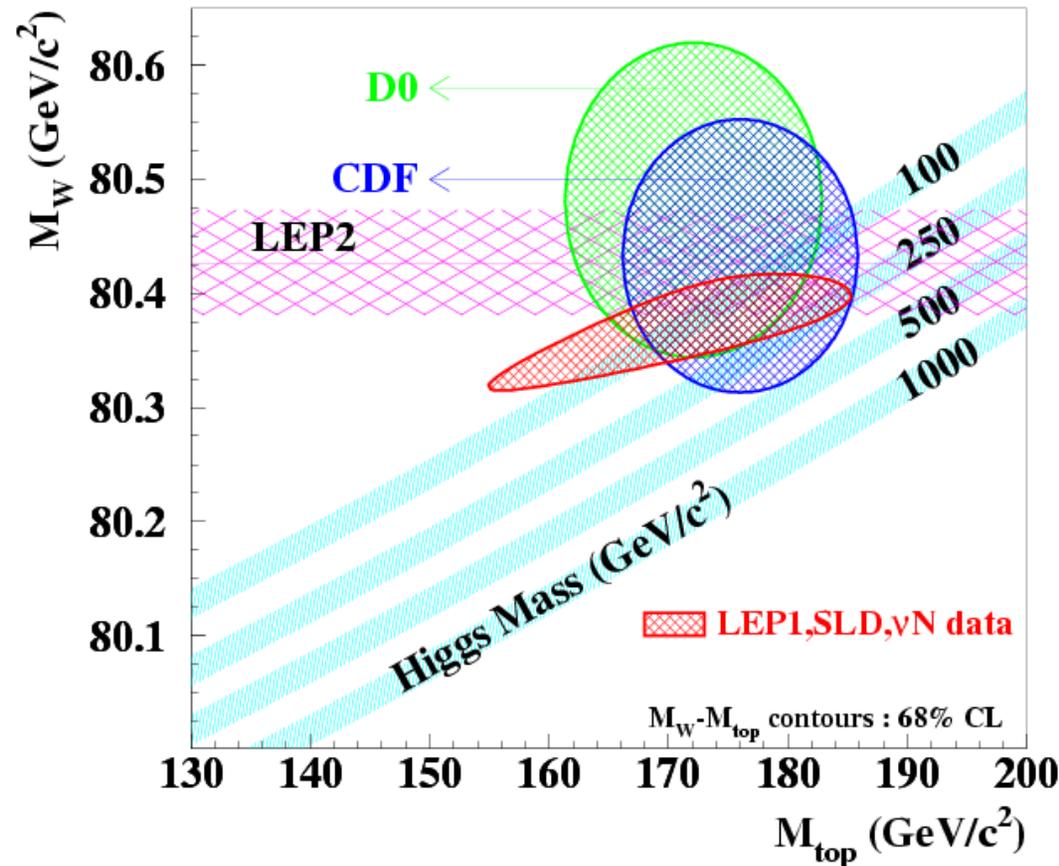
Le Top 'Terra Incognita' !

- Découvert au TeVatron en 95, **mais encore très mal connu**
~100 événements (+ fond) au Run I
- Modèle standard : M_{top} et $M_W \rightarrow$ **déduction masse Higgs**

2 GeV sur M_{top} \approx 10 MeV sur M_W

- Pour 2 fb-1 on attend:

- 4000 événements ttbar (DØ+CDF),
- une précision de 3 GeV sur M_{top} et de 15 MeV sur M_W
- une 1ère mesure du couplage $|V_{tb}|$

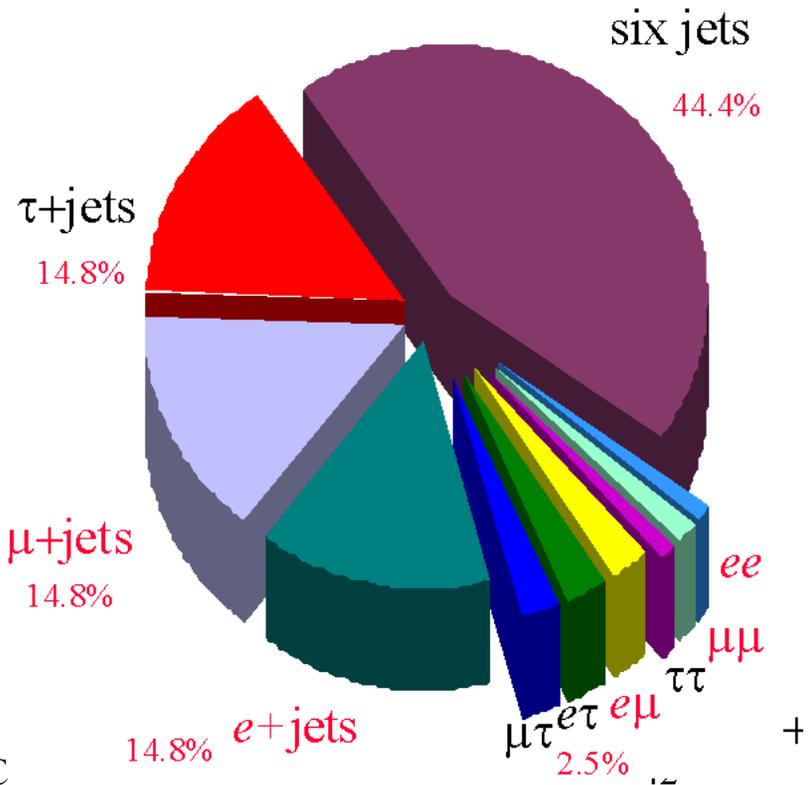
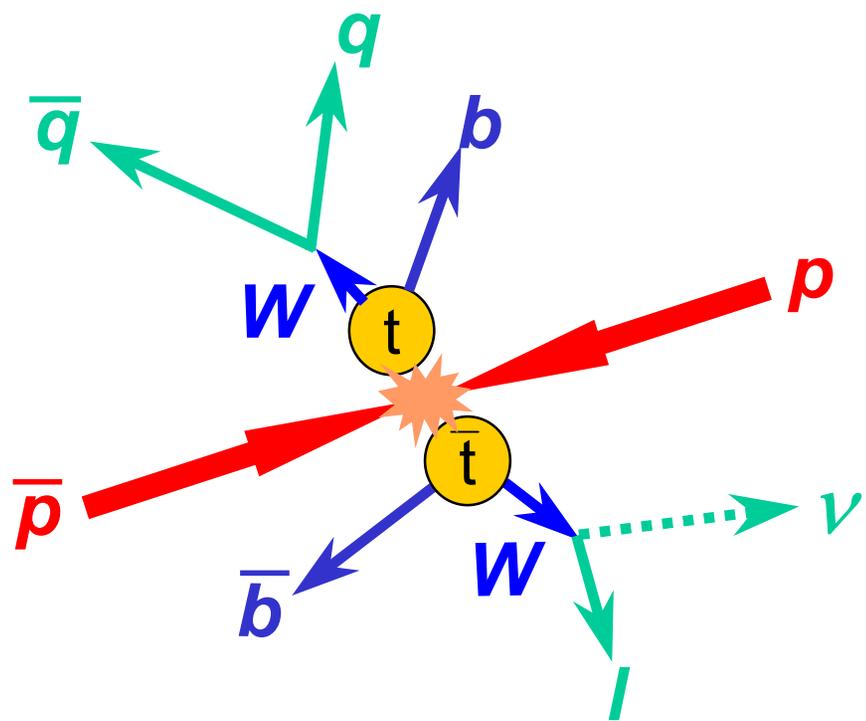


Top : production au Tevatron et désintégration

- ~ 5 pb cross section (7 pb @ 1.96 TeV)
- $p + \bar{p} \rightarrow t + \bar{t} + X$
 - $t/\bar{t} \rightarrow W + b/\bar{b}$
 - $W \rightarrow \ell + \nu$ or $q + \bar{q}'$

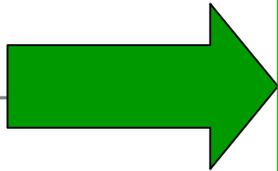
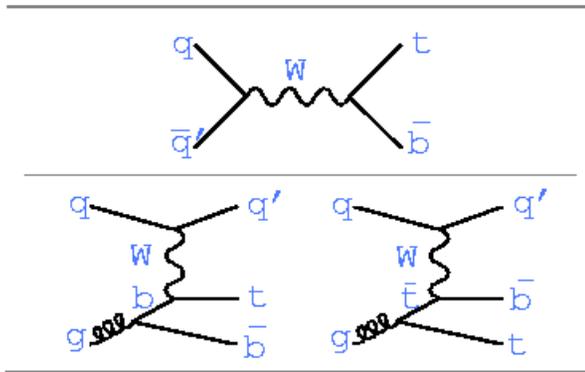
2 b jets

- 6 jets 45%
- e/ μ + 4 jets 15% each
- 2 ℓ + 2 jets $\sim 1\%$ each
- $\sim 35\%$ with τ



Production de 'single' top : accès à V_{tb}

- s-channel: $p\bar{p} \rightarrow t\bar{b} + X$
- t-channel: $p\bar{p} \rightarrow tq\bar{b} + X$



Signal :

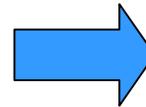
- * 1 lepton de grand p_{-T} (e ou μ)
- * E_{-T} manquante (ν)
- * 2 b énergétiques (si voie s)
- * 1 b énergétique et 1 b "mou" (si W-g fusion)
- * + 1 jet "léger" (si processus 2->3)

Canal W-g $= 2.12 \pm 0.10$ pb

(LHC : 238 ± 12 pb)

Voie s - W^* $\sigma = 0.88 \pm 0.05$ pb

(LHC: 10.2 ± 0.6 pb)



$\sim 1/2$ de σ ttbar !

Refs : Z. Sullivan et N. Sotnikova
<http://home.fnal.gov/~zack/thinkshop/weakint.html>

- Étiquetage des b par électron près de jet
- Collaboration souhaitée avec autres labos de D0-France

Demande de continuation

- **Le groupe DØ - LPSC souhaite continuer son activité d'analyse au Run II jusqu'à fin 2006. Aucune contribution hardware n'est demandée**
- **Cette continuation permettrait :**
 - de bénéficier pleinement du potentiel de physique avec environ 5 fb⁻¹, de luminosité intégrée
 - de valoriser les efforts investis dans la préparation et l'analyse des données
 - d'assurer l'encadrement des doctorants du groupe dans de bonnes conditions
- **Le groupe souhaite conserver son potentiel d'analyse et demande un recrutement CNRS ou au moins un VE ou un postdoc. Une aide informatique soutenue est vivement désirée.**
- **Le groupe souhaite qu'une demande de prolongation éventuelle du LPSC dans DØ au-delà de 2006 et/ou les modalités de transition vers le LHC soient discutées par le CS du LPSC début 2006.**

Les décisions seront alors prises en fonction :

 - des résultats de physique au Tevatron,
 - de l'état d'avancement du LHC

Conclusion

- Le Tevatron a dépassé ses performances du Run I;
- Le détecteur a été amélioré ;
- DØ est désormais dans une phase de fonctionnement opérationnel avec un détecteur performant;
- Avec le plan de montée en luminosité prévu, les résultats de physique sont très prometteurs;
- L'expertise acquise au Tevatron bénéficiera aux équipes du LHC
- Le groupe D0-LPSC souhaite continuer l'analyse des données jusqu'à fin 2006. Il demande que l'avenir du groupe soit examiné début 2006 par le CS du LPSC.

Pour en savoir plus....

FNAL:

<http://www.fnal.gov>

D0:

<http://www-d0.fnal.gov>

D0-France :

<http://d0-france.in2p3.fr>

D0-LPSC

<http://lpsc.in2p3.fr/d0/index.html>

En réserve....

Zoom sur les labos de D0-France

CPPM : 10	(2 CNRS + 3 E-C + 1 Ing + 1 VE + 3 doct)
IPNL : 8	(4 CNRS + 1 VE + 3 doct)
IReS : 11	(4 CNRS + 2 E-C + 1 ATER + 4 doc)
LAL : 13	(5 CNRS + 4 Ing + 1 VE + 3 doct)
LPNHE Paris VI et VII : 7	(3 CNRS + 1 E-C + 3 doc)
LPSC : 6	(2 CNRS + 2E-C + 1 VE + 1 doc)
DAPNIA/SPP : 16	(13 phys + 1 VE + 2 doct)

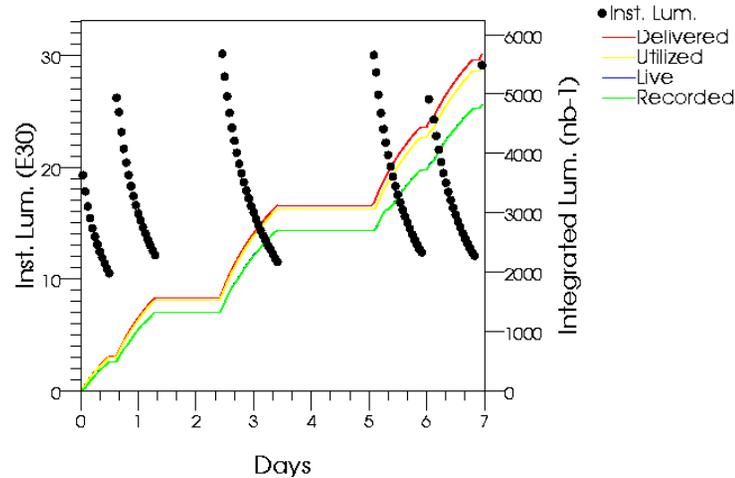


Conclusion

- 1) D0-LPSC le + petit groupe**
- 2) 50% d'E-C**
- 3) Pas d'Ing**



- Delivered Luminosity and operating efficiency
 - ◆ Delivered 5.7pb^{-1}
 - ◆ Recorded 4.8pb^{-1} (85%)
- Reasonably smooth data taking
 - ◆ ~5% front-end busy at ~1.1kHz Level 1 accept rate
 - ◆ ~5% hardware/software failures during beam time
 - ◆ ~5% "natural" pauses: begin/end store, change prescales, etc
- Total number of events collected
 - ◆ 12mn
 - ◆ All events have been reconstructed on the farms



Day of the week

Ref :

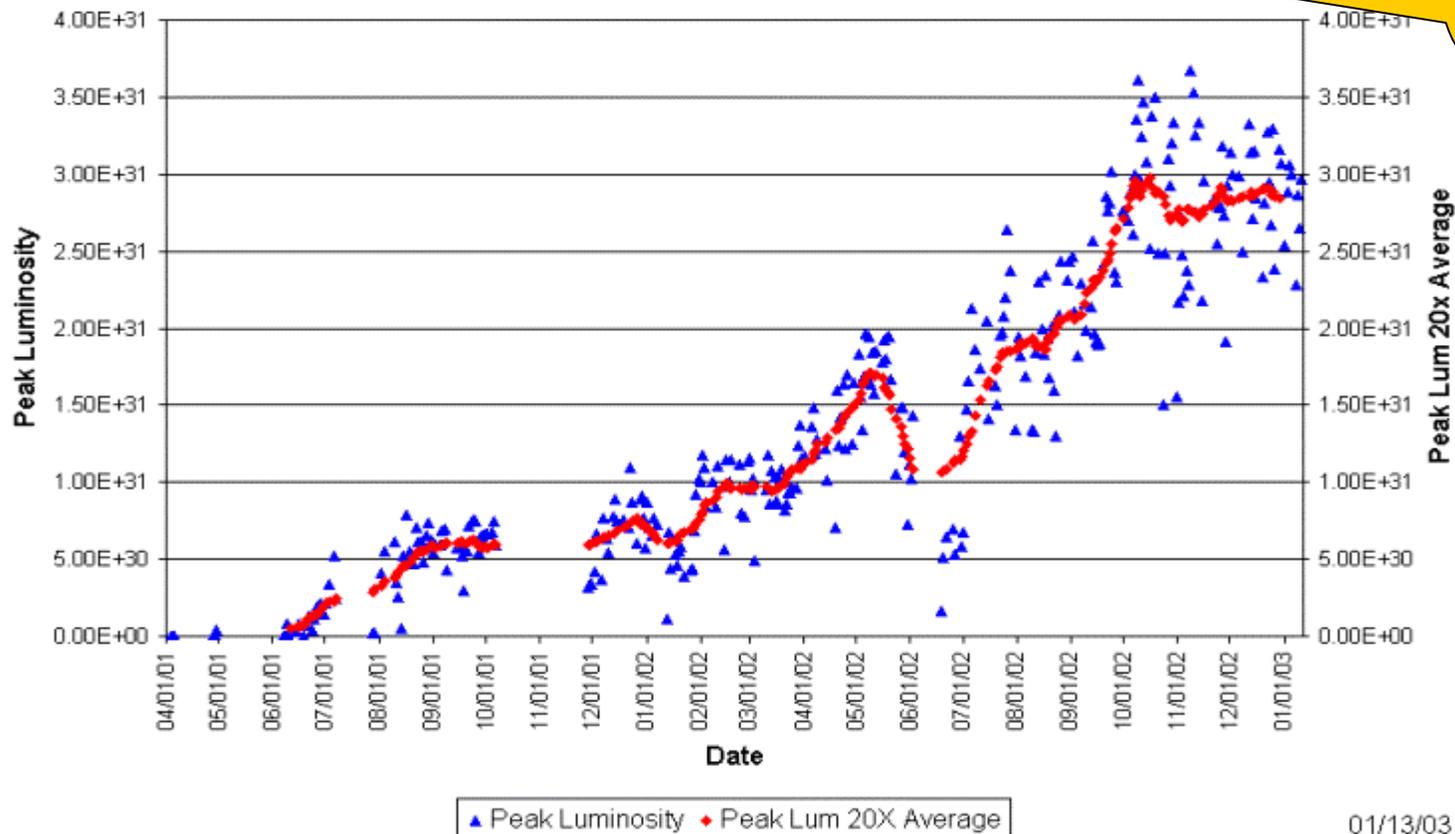
Dmitri Denisov

D.Denisov D0 Run coordinator , FNAL all experimenter's meeting 7 avril 2003

http://d0server1.fnal.gov/projects/operations/AllExptMeet/AllExptMeet_Denisov_030407.ppt

Évolution de la luminosité pic

Collider Run IIA Peak Luminosity



Record
4.03E31
2 mai 2003

Progress in 2002



- Every performance improvement evident in the luminosity performance plot has been associated with a specific modification to the accelerator complex.
- Major modifications since January 1, 2002:
 - Accumulator->Main Injector transfer optics
 - Adjustment of tunes during low beta squeeze
 - Modified injection helix in Tevatron
 - Proton beam loading compensation in Main Injector
 - Accumulator (stochastic) cooling upgrade
 - Accumulator shot lattice
 - Antiproton beam loading compensation in Main Injector
 - Tevatron beam line tuner (BLT)
 - Tevatron tune/coupling drift compensation
 - Tevatron transverse dampers
- Steve Holmes note: $(1.15)^{10}=4.0$

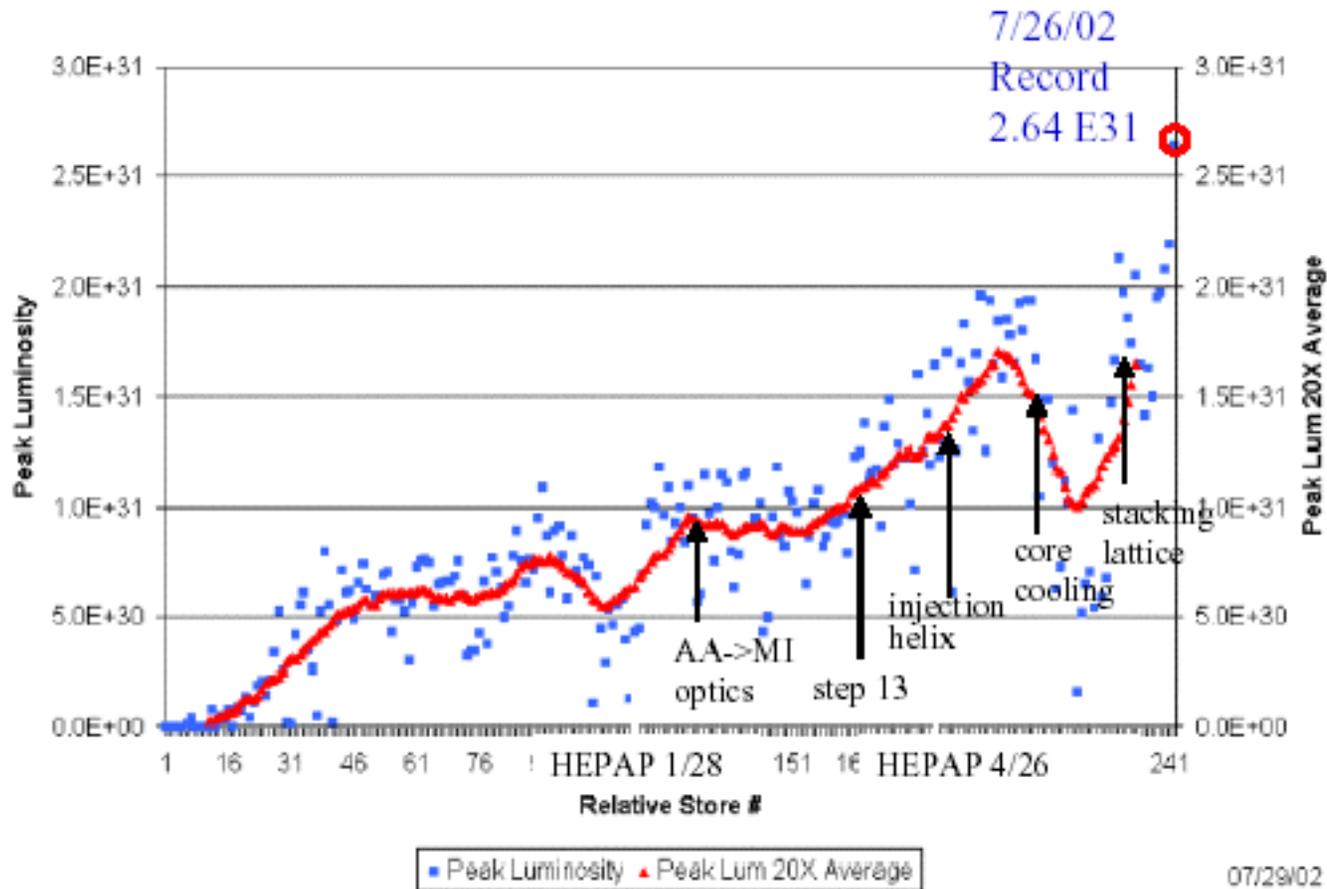
Ref :

M. Witherell Directeur du FNAL HEPAP meeting 7 novembre 2002

Performance: Peak Luminosity



Collider Run IIA Peak Luminosity

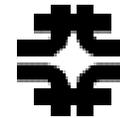


Ref :

M. Witherell Directeur du FNAL HEPAP meeting 5 aout 2002

http://www.fnal.gov/directorate/hepap_0802.pdf

The Major Problems (as of 6/1/02)



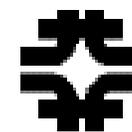
- **Transverse emittance of antiprotons**
 - lattice, cooling ***successfully done; see plot**
 - preserving emittance from Accumulator to collisions
- **Long range beam-beam in the Tevatron**
 - helix
 - aperture
- **Backgrounds (esp. at CDF)**
 - vacuum
 - shielding
- **Other issues**
 - mismatch
 - coalescing
 - beam stability
 - lifetime at 150 GeV

Ref :

M. Witherell Directeur du FNAL HEPAP meeting 5 aout 2002

http://www.fnal.gov/directorate/hepap_0802.pdf

Additional effort on Run II



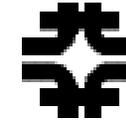
- We have reassigned people to Beams Division and reassigned Run II accelerator tasks to other divisions.
 - See next two pages for snapshot of growing list.
- As of July 15, Steve Holmes is Acting Beams Division Head. Although he retains his role as Associate Director for Accelerators, he is spending full time in the Beams Division.
 - The sign on his door: “If it is not about Run II, I don’t want to talk about it.”
- We are preparing for more:
 - Lists from Particle Physics and Computing Divisions accounting for full effort of all scientists with information about criticality to key projects
 - List from Technical Division of things they could take on
 - List from Beams Division of Run II tasks and personnel needs
 - All-hands memo to the laboratory on additional help for Run II
- We are also making good use of accelerator experts from SLAC, LBL, CERN, BNL, and more.

Ref :

M. Witherell Directeur du FNAL HEPAP meeting 5 aout 2002

http://www.fnal.gov/directorate/hepap_0802.pdf

Added key effort on Run II from the Technical Division



- P. Limon Chair of the Run II Advisory Committee
 & the Recycler effort
- New engineer & tech faster magnet repair and specialty magnet
 construction
- 1 engineer & 1 tech construction of kicker magnets
- R. Stanek magnet spares and vulnerability study
- D. Harding
- Y. Pischalnikov phototubes used for flying wires instrumentation
- G. Romanov studying vibration in the Tevatron RF cavities
 T. Khabiboulline as a possible source of heating
- P. Schlabach magnetic field monitoring of beam line magnets
- 20 technicians tasks during the upcoming shutdown
- Programmers c, c++, and Java programming

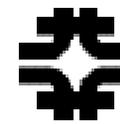
This is a growing list and there will be more in the near future.

Ref :

M. Witherel Directeur du FNAL HEPAP meeting 5 aout 2002

http://www.fnal.gov/directorate/hepap_0802.pdf

Added key effort on Run II from the Particle Physics and Computing Divisions



- S. Pordes overall responsibility for Instrumentation.
- J.Spalding Project Manager for the Run IIb accelerator project
- H. Jostlein vacuum for the Recycler
- M. Larwill loss monitor system for the Booster
- C. Drennan flying wire system for the antiproton source
- C. Rivetta beam loading compensation in the Main Injector
- W. Johnson installation of beamline instrumentation
- S. Morrison
- H. Cheung Synchlight monitors
- A. Hahn
- P. Lebrun Shot Data Analysis (SDA)
- S. Panacek
- P. Spentzouris simulations of space charge effects in the Booster
- J. Amundson
- D.Slimmer labview software for the pbar flying wires system
- many technicians tasks during the upcoming shutdown

This does not include less formal study groups on, for example losses.

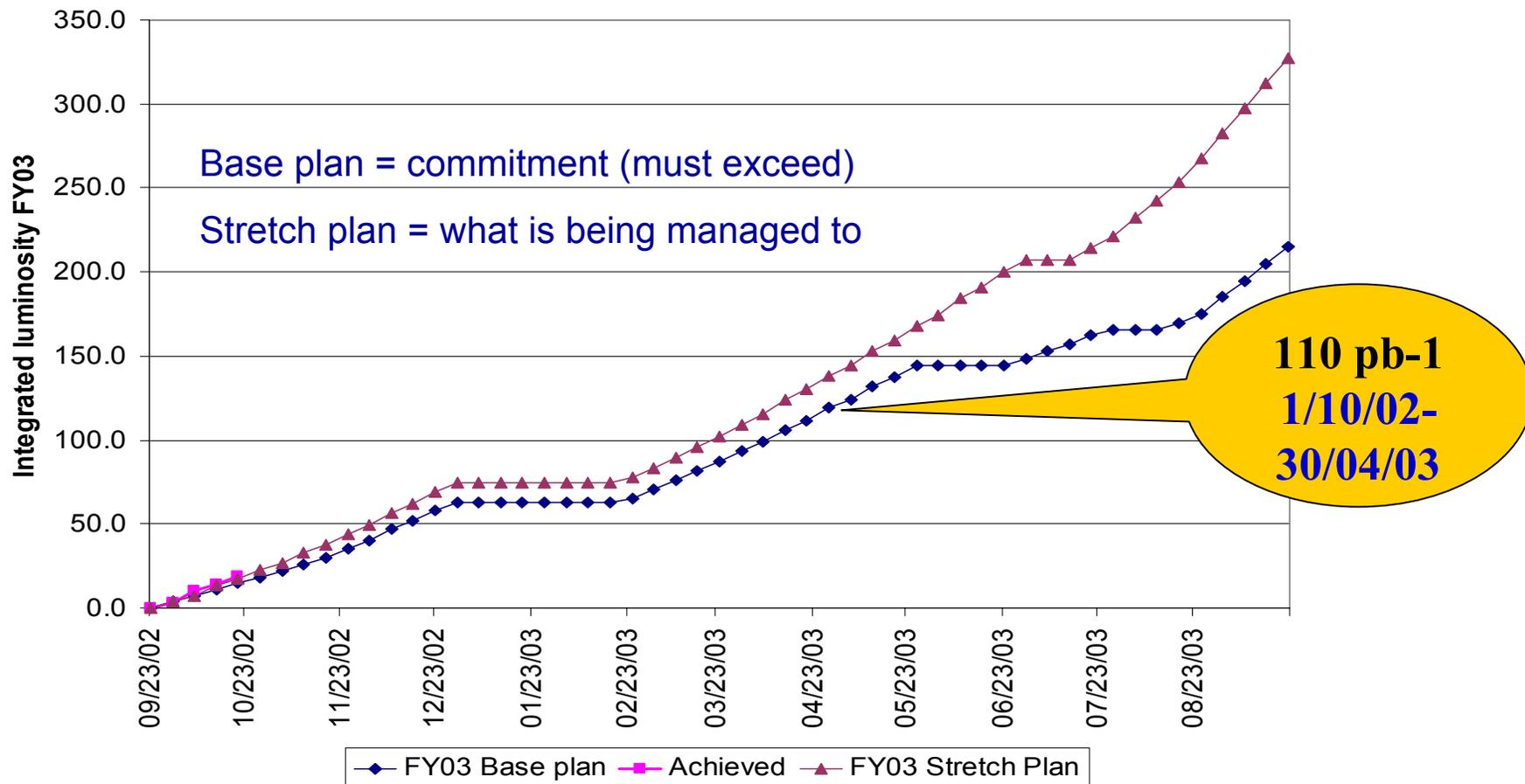
This is a growing list and there will be more in the near future.

Ref :

M. Witherell Directeur du FNAL HEPAP meeting 5 aout 2002

http://www.fnal.gov/directorate/hepap_0802.pdf

Prévision FY 2003 : 200-300 pb-1



Run IIa Luminosity Goals

For Run I:

- Typical peak luminosity $\sim 1.6 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$
- Typical weakly Integrated luminosity $\sim 2 \text{ pb}^{-1}$
- Total integrated luminosity delivered $\sim 0.14 \text{ fb}^{-1}$
- The official luminosity goal for Run IIa was defined in the data sheet for the Main Injector Project:
 - “The Tevatron proton-antiproton colliding beam luminosity will be increased to at least $5 \times 10^{31} \text{ cm}^{-2} \text{ sec}^{-1}$.”
 - Total integrated luminosity of 2 fb^{-1}
- Lab is committed to exceed that official goal with additional effort and the Recycler. The limits are believed to be:
 - 8×10^{31} without the Recycler
 - 2×10^{32} with full benefit of the Recycler

Le RunIIb en 3 transparents (1/3)

Motivations

The Tevatron Collider at Fermilab is currently the only facility in the world capable of making a Higgs discovery. Simulation studies have shown that the two Tevatron Collider experiments, CDF and DØ, are sensitive to the Higgs over almost all of its presently allowed mass range. Our goal is to accumulate sufficient data to make a sensitive search for the Higgs that will have a high probability of success if the Standard Model predictions are correct.

These goals cannot be achieved without upgrades to the DØ detector. The silicon tracking detector is not expected to survive beyond the 2-4 fb⁻¹ of integrated luminosity that will be delivered during Run IIa, well short of the 15 fb⁻¹ goal for Run IIb. The corresponding increase in instantaneous luminosity necessitates upgrading the trigger system to maintain high trigger efficiency for the Higgs search and other elements of the Run IIb physics program while providing the required background rejection. Finally, data acquisition (DAQ) and online computing upgrades are needed to continue efficient operation of the experiment beyond Run IIa.

http://d0server1.fnal.gov/projects/run2b/meetings/DOEReviews/EIR_Nov02/D0_Run2b_TDR.pdf

Le RunIIb en 3 transparents (2/3)

Silicon tracker

The current DØ silicon tracker was built to withstand the $2 - 4 \text{ fb}^{-1}$ of integrated luminosity originally projected for Run II. Because of the tantalizing physics prospects a higher integrated luminosity brings, the laboratory supports extended running of the Tevatron collider, called Run IIb, which would deliver a total integrated luminosity of 15 fb^{-1} over the course of the full Run II. However, the higher integrated luminosity now scheduled for Run IIb will render the inner layers of the present silicon tracker inoperable due to radiation damage. Of particular importance to be able to exploit the physics potential of the Tevatron is the construction of a replacement of the silicon detector in approximately three years with minimal Tevatron down time. The DØ collaboration carefully studied two options for a Run IIb silicon tracker replacement: "partial replacement" and "full replacement." In the partial replacement option, the present tracker design is retained and the inner two silicon layers are replaced with new radiation tolerant detectors. In the full replacement option, the entire Run IIa silicon tracker is replaced with a new device. An internal review of these two options identified significant risks with the partial replacement option. These include the risk of damage to the components not being replaced, the long down-time required to retrofit the existing detector, an inadequate supply of the SVX2 readout chips, difficulties in adequately cooling the inner layers, and marginal radiation hardness for the extended operation of Run IIb in the layers not being replaced. Furthermore, it is nearly impossible to re-optimize the detector for the Run IIb physics program with the partial replacement option. For these reasons, DØ decided to proceed with the full replacement option for Run IIb and build a new silicon tracker that is optimized for the Higgs search and other high- p_T physics processes.

Le RunIIb en 3 transparents (3/3)

Trigger

Laboratory guidance for Run IIb is that a luminosity of $2 \times 10^{32} \text{ cm}^{-2} \text{ sec}^{-1}$ with 396 ns bunch spacing and luminosity leveling is the baseline plan, but that CDF and DØ should have the capability of operating at higher instantaneous luminosities with either 132 ns or 396 ns bunch spacing should luminosity leveling not meet expectations. Our proposed trigger upgrade is consistent with this guidance.

DAQ

<i>Parameter</i>	<i>Run IIa</i>	<i>Run IIb</i>
Level 3 farm nodes (dual processors)	112	160
Average event size	~ 250 Kbytes	~ 300 Kbytes
Level 3 input rate	1000 Hz	1000 Hz
Peak Level 3 accept rate	50 Hz	100 Hz
Peak logging rate	12.5 Mbytes/sec	30 Mbytes/sec
Detector duty factor	> 99%	> 99%
Accelerator duty factor	~ 75%	~ 75%
Online system availability	> 99%	> 99%
Local data buffer	48 hours	48 hours
Local data buffer	~ 2 Tbytes	~ 4 Tbytes